

Interpreting Aristotle's *Posterior Analytics*
in Late Antiquity and Beyond

Philosophia Antiqua

A Series of Studies on Ancient Philosophy

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VOLUME 124

Interpreting Aristotle's *Posterior Analytics* in Late Antiquity and Beyond

Edited by

Frans A.J. de Haas, Mariska Leunissen and Marije Martijn



BRILL

LEIDEN • BOSTON
2010

This book is printed on acid-free paper.

Library of Congress Cataloging-in-Publication Data

Interpreting Aristotle's Posterior analytics in late antiquity and beyond / edited by Frans A.J. de Haas, Mariska Leunissen, and Marije Martijn.

p. cm. – (Philosophia antiqua ; v. 124)

Includes bibliographical references and index.

ISBN 978-90-04-20127-9 (hardback : alk. paper)

1. Aristotle. Posterior analytics. 2. Logic. 3. Knowledge, Theory of. 4. Definition (Philosophy)
I. Haas, Frans A. J. de, 1963- II. Leunissen, Mariska, 1979- III. Martijn, Marije.

B441.I58 2010

160-dc22

2010050006

ISSN: 0079-1687

ISBN: 978 90 04 20127 9

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PREFACE

This volume brings together a number of papers connected to the program *From natural philosophy to science: 1200–1700* funded by the European Science Foundation. In that framework the team ‘The anatomy of science: logic and method’, led by De Haas, organised two workshops. The first was organised by the editors of this volume and devoted to *Interpretations of Aristotle’s Posterior Analytics* (Leiden, Netherlands, 1–4 June 2004); the second was devoted to *Intuitive Knowledge, Induction, and the Role of Experiment* (Maynooth, Ireland, 10–12 June 2005). The editors gratefully acknowledge the financial support provided by the ESF without which this enterprise would not have been possible. Martijn’s work on this volume has in part been made possible by a Veni-grant of the Netherlands Organization for Scientific Research NWO, project 275-20-020.

The Maynooth conference was organized by the late John Cleary, who, with the help of his Maynooth colleagues, saw it through successfully despite the fact that his wife had just fallen seriously ill. His unfailing support for the ESF project, his intense commitment to the understanding of ancient philosophy, but also his cheerful jokes and remarkable tales will always be remembered by everyone who participated in the workshops. This volume is devoted to his memory.

The papers we selected for publication were substantially revised and updated to the current state of research. Owen Goldin, who participated in the Leiden workshop, kindly accepted the invitation to prepare a new paper, since his original paper was already in press at the time of delivery (Goldin 2004). In the introduction and bibliography we have aimed at providing access to the rapidly growing field of the reception of the *Posterior Analytics* in later Greek Antiquity, and the Byzantine, Arabic, and Latin Medieval philosophical traditions. We have not aimed at providing a complete bibliography, but we are confident that the scholarship we did include will provide both the general and the specialized reader with the means to pursue his or her interests.

The editors incurred a number of debts while preparing this volume. It will be hard to compensate for the patience of our contributors, and we are truly grateful that they bore with us until we were able to bring the project to the press. James Lesher and Henrik Lagerlund kindly

informed us about forthcoming publications that we were thus able to include in our bibliography. For last minute advice on parts of the introduction we are indebted to Katerina Ierodiakonou, Michele Trizio, and the members of the research group Ancient and medieval philosophy at the VU University Amsterdam.

Frans de Haas
Mariska Leunissen
Marije Martijn

Leiden, 17th March 2010

INTRODUCTION

One of the major contributors to research on the *Posterior Analytics*, Jonathan Barnes, once wrote that the text “plays Cinderella in the Aristotelian pantomime”¹—in the sense that she used to be disregarded but is recently followed around by a host of suitors. What is true of the *Posterior Analytics* now, has been true during the Middle Ages (Byzantine, Arabic and Latin) in a very specific sense. When medieval philosophers wrote commentaries on Aristotle’s *Posterior Analytics* they did not aim at giving an overview of the work for its own sake or at clarifying its place in the corpus and its relation to other Aristotelian works. Instead, they made the text play the proverbial Cinderella by having it scrub the floors: either the commentaries had an external aim, primarily the defense of theology as a science, or the commentators selected a fairly limited number of themes useful to the areas of philosophy of their interest. The roots of this treatment of the *Posterior Analytics* can be found in the ancient commentary tradition, although there it is still part of a more comprehensive approach to the work.

The treatment of the *Posterior Analytics* became an instrument in a development characteristic for the transition from natural philosophy to science, namely a progression of the awareness and sophistication of method and logical argument. Here we bring together a collection of essays that trace these developments in the discussions of scientific method and argument in the comment(arie)s on Aristotle’s *Posterior Analytics* and related methodological passages in the Aristotelian corpus. Despite the importance of these discussions the larger part of the commentary tradition on the *Posterior Analytics* still remains uncharted. This collection aims to open up this new line of research by identifying and exploring three important strands of interpretation related to (1) the reception of Aristotle’s logic of inquiry and theory of concept formation in *Posterior Analytics* II 19; (2) the influence of the *Posterior Analytics* on the evaluation of metaphysics as a science; and (3) the reception of Aristotle’s theory of demonstration, definition, and causation in *Posterior Analytics* book II.

¹ Barnes (1993) 225.

Before presenting a summary of the contributions to this volume, we provide a concise treatment of the state of research on the tradition of the *Posterior Analytics* in Late Antiquity, and the Byzantine, the Arabic and the Latin Middle Ages, with emphasis on the most recent literature. Our treatment of the tradition is by no means exhaustive, but that is not its aim. Instead, we wish to set the scene for the essays contained in this volume, among others by showing that the chapters and themes that were isolated to do the 'dirty work' were especially those fitting the growing awareness of method and argument, i.e., regarding the requirements of a demonstrative science, *per se* predication, the necessity of proof, knowledge of principles, universals, induction, and, last but by no means least, the sub-alternation of sciences.²

1. THE ANCIENT RECEPTION OF THE *POSTERIOR ANALYTICS*

Galen, the highly successful physician-philosopher who was active in the second century AD, is one of the earliest ancient thinkers in whose work we find an explicit engagement with Aristotle's *Posterior Analytics*, which was probably most focused in his *On demonstration*, a treatise on scientific demonstration that has come to us only in fragments. An overall impression of its contents can be gleaned from references in other treatises, especially in *On the doctrines of Hippocrates and Plato* and *On the method of healing*.³ Galen's logical works were deeply indebted to Aristotle, and his views in turn were discussed in the works of Alexander of Aphrodisias, Themistius, and the Neoplatonists. His work on demonstration shows his conviction that once the proper elements and starting points have been discovered, one can prove everything that allows for proof, not least in medicine and philosophy.

The next important figure in this context is Alexander of Aphrodisias—a Peripatetic philosopher and prolific commentator on Aristotle, working in the late second and early third century AD. As 'the (ancient)

² For comments from major figures in the tradition on specific passages from the *Posterior Analytics*, the best place to start is Mignucci's commentary on book I (1975), since he incorporates in his exegesis of the text a wealth of material from Alexander, Themistius, Philoponus, Averroes, Aquinas, Zabarella and others.

³ For a collection of the fragments see Von Müller (1895). Chiaradonna (2009) sets out to reconstruct the content of *De demonstratione*. Galen's version of an Aristotelian theory of science is discussed in, among others, Barnes (2003), Lloyd, G.E.R. (1996), Morison (2008), Tieleman (2008). More in particular, the nature of explanation and demonstration in Galen have been discussed by Hankinson (1991, 1994a, 1994b).

Commentator' *par excellence* he enjoyed great authority among his successors. The influence of his works (many of which are now lost) is palpable in all later commentaries on Aristotle. In the fragments that remain of his commentary on the *Posterior Analytics*⁴ he usually stays close to Aristotle's text.⁵ Nevertheless we can see how Alexander executes a critical systematization of the work, explores the relationship between demonstration and dialectic,⁶ grants inferences from effect to cause the title of 'demonstration', and raises objections to Aristotle in the style of his *Quaestiones*. In Alexander's commentary on the *Metaphysics* we find an interesting perspective on the reception of the *Posterior Analytics*, since Alexander thought that, in Aristotle's presumed unitary corpus, the latter work provided the scientific theory for the former.⁷ Thus Alexander shapes his reading of the *Metaphysics* as a demonstrative science on the criteria set out in the *Posterior Analytics* and discusses the genus, the axioms and the theorems of philosophy. This perspective was to find its sequel in the medieval discussions on theology and metaphysics as demonstrative sciences.

In the fourth century, two main authors continue the tradition. In the Greek world, Themistius, the rhetorician, statesman and philosopher, who, as Blumenthal has shown, "may rightly claim to have been the last major figure in antiquity who was a genuine follower of Aristotle",⁸ wrote a paraphrase of the *Posterior Analytics*. Until recently, the paraphrase had been studied primarily in the context of Themistius' general method of paraphrasing, but new studies have revealed that the paraphrases are more than mere rehashes of the original, and that they contain useful information on the late ancient understanding of Aristotle's text.⁹

During the same century, in the Roman world, Marius Victorinus, who was an important figure in the transferring of Greek Neoplatonism to Christian doctrine in the Latin West, wrote the only extant ancient

⁴ Moraux (1979). To his edition of the fragments, Moraux added an anonymous commentary on the *Posterior Analytics* which he claims was compiled from Alexander's commentary. For the fragments of a commentary attributed to 'Alexander' by medieval thinkers, but now considered to have been written by Philoponus, see below.

⁵ See Goldin, Chapter Eight, in this volume for Alexander as the originator of an important strand of interpretation of *Posterior Analytics* II 1–10.

⁶ On this theme see further Tuominen, Chapter Seven, in this volume.

⁷ See Bonelli (2001) and her contribution to this volume, Chapter Five.

⁸ Blumenthal (1979/1990), 123 (page ref. is to reprint).

⁹ See Volpe Cacciatore (1995) and Achard (2005, 2006, 2008), who studies Themistius' use of Meno's paradox in his paraphrase of the first chapter of the *Posterior Analytics*.

treatise that is entirely devoted to definitions and the art of defining.¹⁰ Although Marius' main source is Cicero, he was well acquainted also with the *Posterior Analytics*, albeit probably not directly. On the basis of these and other sources, Marius ends up distinguishing fifteen kinds of definition altogether.

The second Latin contribution to the tradition is that of 6th century Boethius, who is well known for his grand project of translating and commenting on the works of Aristotle and Plato. A number of his translations and commentaries on Peripatetic logic remain, but Boethius probably did not get down to translating or commenting on the *Posterior Analytics*. He was, however, acquainted with its contents. In general, Boethius' attitude in interpreting Aristotle's logical works is characterized by following Porphyry rather than other commentators, so as to prevent a Platonizing reading of the works and to maintain the proper order of the curriculum: when studying Aristotle's logic one is not ready yet to venture into Platonic metaphysics.¹¹

For the Neoplatonists the *Posterior Analytics* keeps its role as the provider of the theory of science, albeit in a fruitful mixture with Platonic dialectic. This has been shown, for example, for Syrianus, the fourth century head of Plato's Academy, with respect to the principles of metaphysics,¹² and for his successor Proclus, who argued that the physics in Plato's *Timaeus* constitutes a demonstrative science with its own genus and axioms.¹³

The views of Proclus and Syrianus were brought to Alexandria by Proclus' student Ammonius, whose main contribution consists in his 'neoplatonizing' readings of Aristotle's works, and, probably, the occasional adjustment of the highly elaborate metaphysics of his teacher to the requirements of his Christian environment. Ammonius connected Aristotle's concept of *nous* as intimated in *Posterior Analytics* II 19 with the Platonic theory of innate Ideas, in their Neoplatonic shape of cognitive reason principles (*logoi*).¹⁴ For Ammonius, *nous* is the capacity by which we obtain knowledge of the divine—an interpretation that becomes very important in the use of the *Posterior Analytics* in medieval Augustinianism.

¹⁰ For a German translation, with introduction and comments, see Pronay (1997).

¹¹ See Ebbesen (2009).

¹² See Longo (2005).

¹³ See Martijn (2010) and (forthcoming).

¹⁴ Tempelis (1997). For an earlier version of this reading of *Posterior Analytics* II 19 see Helmig in this volume, Chapter Two.

The most influential contribution from the Neoplatonic schools with regard to the medieval tradition is the commentary on the first book of the *Posterior Analytics* written by the 6th century Christian Neoplatonist John Philoponus. In the translation of James of Venice, it stands at the beginning of the medieval reception of the *Posterior Analytics*.¹⁵ Further fragments of Philoponus' work have been unearthed in medieval translations and commentaries of a text that at the time was ascribed to Alexander.¹⁶

So far Philoponus' mixture of Platonic, Aristotelian, and Euclidean theory of science has hardly been the subject of scholarly interest—possibly because his reading of the *Posterior Analytics* was considered not very creative or enlightening. However, Morrison has drawn attention to the development of the proof from irrefutable signs (the so-called 'tekmeriodic proof') which appears in Philoponus' commentaries on the *Posterior Analytics* and *Physics* as well as in Simplicius—perhaps a piece of doctrine that originated with their teacher Ammonius. This kind of proof, constructed on a narrow textual basis in Aristotle's *Rhetoric* and *Prior Analytics*, warrants the claim that at least some inductive arguments, or arguments from effects to causes, may have demonstrative force. Furthermore, Morrison has argued that this view of tekmeriodic proof may stand at the root of the Renaissance method of *regressus*.¹⁷ More recently De Haas has connected the wealth of mathematical doctrine and examples in Philoponus' commentary to the project of the 'mathematization' of philosophy started by Iamblichus. Both the development of the proof from signs and Philoponus' comments on circular proof in *Posterior Analytics* I 3 can be connected to this project and to a long-standing debate between philosophers and mathematicians.¹⁸

Another influential text traditionally ascribed to Philoponus is the commentary on the second book of the *Posterior Analytics*. The interest of this text lies both in the mysteries surrounding its author, and in

¹⁵ Philoponus' commentary on the first book has partly been translated by McKirahan (2008). The remainder of book I is forthcoming (McKirahan 2010, Goldin and Martijn 2010). For a translation of Philoponus' reading of the first chapter of the *Posterior Analytics* see also Achard (2006, revised in Achard 2008). On the role this commentary (or Alexander's) may have had due to James of Venice's translation, see the section on Latin medieval philosophy.

¹⁶ Minio-Paluello & Dod (see n. 44) and Ebbesen (2008, revised and augmented version of Ebbesen 1990). See Ebbesen's bibliography for references to further publications of fragments.

¹⁷ Morrison (1997). For a critical response, see De Haas (1999).

¹⁸ See De Haas (2009) and (forthcoming).

its role in the reception of the *Posterior Analytics* in the Middle Ages. Recently it has been proposed that the text is a condensed paraphrase of a lost commentary by Philoponus or another author from the school of Ammonius,¹⁹ or, alternatively, a report of Ammonius' lectures on the subject corrected by Philoponus himself.²⁰ Among other things, the commentary provides an intriguing account of *Posterior Analytics* II 1–10 as exploring how different kinds of scientific syllogisms may serve to clarify different aspects of the essence of a kind.²¹

2. THE RECEPTION OF THE *POSTERIOR ANALYTICS* IN BYZANTIUM, ARABIC THOUGHT AND THE LATIN MIDDLE AGES

Byzantine philosophy

The Byzantine philosophical tradition in general is only recently starting to receive more scholarly attention, and this renewed interest materializes also in writings on the Byzantine reception of the *Posterior Analytics*.²² Unfortunately, the material on the *Posterior Analytics* is quite scarce—we know of commentaries by Eustratius (second half 11th c. – early 12th c.), Prodromos (12th c.), and possibly Chortasmenos (late 14th c. – early 15th c.), which, either illustrating or explaining their selective use made of the *Posterior Analytics*, concern only its second book, and summaries and remarks by among others Pediasimos.²³ Since the authors rely mainly on Philoponus(?)' commentary on the second book, the question of the authorship of the latter is quite relevant to our understanding of this tradition.

An important part of the contributions to the study of the Byzantine *Posterior Analytics* tradition consists in the editing of available material, e.g., De Falco's editions of the scholia of Pediasimos (1926 and 1928) and Cacouros' edition of Prodromos' commentary on the second book of the *Posterior Analytics* (1992).²⁴ Quite some material, especially scholia,

¹⁹ See the introduction of Goldin (2009).

²⁰ See Sorabji in his preface to Goldin (2009) viii–ix.

²¹ See Goldin, Chapter Eight, in this volume.

²² For a survey of Byzantine authors and their works on the Aristotelian *Organon* see Benakis (1988).

²³ See further Ierodiakonou, Chapter Three, in this volume.

²⁴ De Falco (1926, 1928). The latter is a publication of scholia De Falco did not include in his edition. Among them are quotations from Philoponus' *In Analytica Posteriora*, which provide alternatives to or confirmations of emendations in Wallies' editions of Philoponus. Cf. Cacouros (1992).

remains to be edited. As is to be expected, therefore, discussions of the content of the texts, and of the role of the *Posterior Analytics* in Byzantine thought, are still few and far between.

Despite the overall scarcity of the available material, one still gets a fairly good idea of the themes from the *Posterior Analytics* that were most relevant to Byzantine philosophers, for example from Eustratius' preface to his commentary. The prefaces to the commentaries traditionally contained a discussion of the title and the overall aim, or *skopos*, of the work commented upon, followed by a treatment of a number of issues specific to the (kind of) work. Eustratius' extensive preface, which Cacouros used as the starting point of a general survey of such prefaces in both ancient and Byzantine commentaries on the *Posterior Analytics*,²⁵ reveals that in the case of the *Posterior Analytics*, the main issue was the distinction of four methods of acquiring knowledge: definition, demonstration, division and analysis.

Eustratius, the 12th century metropolitan bishop of Nicaea, better known for his commentary on the *Nicomachean Ethics*, deserves more attention. His nominalist reading of Aristotle, which Lloyd has called a form of conceptualism, bears heavy marks of Neoplatonism, especially of Proclus' metaphysics, but displays fairly little explicit Christian doctrine.²⁶ While Eustratius' commentary on the second book of the *Posterior Analytics* is our main source for fragments of Alexander's views,²⁷ at the same time it contains a number of typically Neoplatonic views—e.g., in its treatment of the question whether the genus consists of its species, in a Neoplatonic mereology of forms, and in the use of the notion of transcendent universals as first of a series.²⁸

Of the later Byzantine tradition, Palamas and Barlaam are worth mentioning, despite the fact that they did not comment specifically on the *Posterior Analytics*. In a debate on the best way to obtain knowledge of God, they both use the *Posterior Analytics* in support of their position.²⁹

²⁵ Cacouros (1998), see also (1989, 1996).

²⁶ See, however, Ierodiakonou in this volume on the role of Christian dogma in Eustratius' reading of Aristotle.

²⁷ See p. xi, and Goldin in this volume.

²⁸ See Lloyd, A.C. (1987).

²⁹ See Ierodiakonou (2002).

Arabic Philosophy

The Arabic reception of the *Posterior Analytics*, like the Byzantine one, has received very little scholarly attention, possibly because the Arabic logicians dropped all but a few formal topics from the *Posterior Analytics* (viz. the discussion of definitions) from the curriculum. On the other hand, in this period the whole view of how to do science was informed by the *Posterior Analytics*. Not surprisingly, therefore, recent work has established that the work had a substantial influence on Arabic thought, as well as on Latin Medieval and Renaissance thought, through Arabic interpretations.³⁰ This influence is mainly indirect, through the incorporation and modification of elements of Aristotle's theory of science.

For example, both the political thought of 'the Second master' al-Farabi (c. 870–950) and Avicenna's (980–1037) metaphysics were influenced by the *Posterior Analytics*. In fact, the latter even tried to apply the method outlined in the *Posterior Analytics* to his metaphysics as the science of God and separate causes.³¹ Conversely, Avicenna and consequently al-Ghazali (1058–1111) tried to adjust Aristotle's theory of science in order to make it fit demonstration of the 'perishable particular' and an occasionalist theological metaphysics respectively.³² Averroes (1126–1198), on the other hand, in his *Prooemium to the Physics*, modified and extended the different kinds of demonstration from the *Analytics*. These extended kinds of demonstration are subsequently taken over in the so-called "Oxford gloss" and in Petro d'Afelro's commentary on the *Prooemium*.³³

One of the earliest direct interpretations of the *Posterior Analytics* in the Arabic tradition is found in Avicenna's *Book of Demonstration*.³⁴ Avicenna, the Persian scientist and philosopher, presents an interesting notion of subordination of sciences, according to which a science may lead to a knowledge transcending it, most notably when its principles become the object of inquiry in a superior science.³⁵ He moreover

³⁰ See Burnett (2005) 391–400 for a list of Latin translations of Arabic sources during the 13th–16th century, including *Posterior Analytics* commentaries.

³¹ See Lizzini (2005), Bertolacci (2002).

³² See Marmura (1990).

³³ See Burnett and Mendelsohn (1997).

³⁴ Edited by Badawi (1954).

³⁵ Lizzini (2005).

severely criticizes Aristotle's notion of induction and replaces it with 'experimentation', which leads to conditional, rather than absolute, necessary knowledge.³⁶

Averroes also offers a direct interpretation of the *Posterior Analytics* in his middle and great commentaries on the *Organon*.³⁷ The textual tradition of these commentaries, however, is highly complex. Gätje and Schoeler demonstrate this concerning his *Great Commentary* on the *Posterior Analytics*, on the basis of several case studies. The main point the authors make is that while for his *Great Commentary* on the second book of the *Posterior Analytics* Averroes used the fairly literal translation of AbūBišr Mattā (Matthaeus, †940), for the first book (as for the Middle Commentary) he instead used a different text—probably an anonymous reworking of Matthaeus' translation.³⁸ Averroes does not indicate the switch, which he may have made upon realizing that the reworking was not always reliable.³⁹ Hugonnard-Roche argues that the translation made by AbūBišr Mattā (who aimed at presenting Aristotelianism in a systematic way) was in many respects already an interpretation and that the anonymous reworking is based on Themistius' commentary. As a result, the texts Averroes based his commentaries on were already (at least to some extent) commentaries on the *Posterior Analytics* themselves.⁴⁰ Averroes' comments are themselves of special interest because of his aims: to present a pure reading of Aristotle, and a logic independent of religion.

Latin Medieval Philosophy

In the use of the *Posterior Analytics* in the Latin Middle Ages, the development of both the systematic and the eclectic reading of the text reaches new heights.⁴¹ The themes selected in the latter are primarily *metabasis* and the subalternation of sciences, induction and knowledge of first principles, and the different notions of *per se* predication. Other, related themes that are popular in the reception of the *Posterior Analytics* in the

³⁶ McGinnis (2003).

³⁷ Edited by Badawi (1984) and Butterworth (1982).

³⁸ Mattā, in turn, based his translation on the 9th century Syriac translation of Hunayn. For an edition of Mattā, see Badawi (1948–1952), 309–465.

³⁹ Gätje and Schoeler (1980).

⁴⁰ Hugonnard-Roche (1999).

⁴¹ See, e.g., De Rijk (1990b), Longeway (2005, and forthcoming). On the reception of the *Posterior Analytics* in the 12th and 13th century, see also Antolic, Chapter Four, in this volume.

Latin Middle Ages from Grosseteste onwards, are in general the requirements for demonstration, the nature of universals, the role of causes in demonstrative syllogisms, the relation between demonstrative science and other sorts of knowledge, and the tension between demonstration and science of nature.⁴²

An enormous change occurred in the landscape of philosophy when, in the twelfth century, the *Posterior Analytics* became known in the West. The main engine of this change was James of Venice's translation of the Aristotelian text and of a commentary, probably Alexander's, or possibly that by Philoponus.⁴³ In addition there is the anonymous translation of the *Posterior Analytics* by 'a certain Ioannes', and Gerard of Cremona's translation, which is based on an Arabic source.⁴⁴

One of the most influential figures in the tradition of the *Posterior Analytics* is certainly Grosseteste (c. 1175–1253), who was the first great Latin medieval interpreter of the *Posterior Analytics*.⁴⁵ His reading of the *Posterior Analytics* has been mined for traces of the ancient tradition, notably Philoponus and Alexander.⁴⁶ Grosseteste explained the *Posterior Analytics* as itself structured as a work of demonstrative science, and provided a useful list of its conclusions (32 for each book).⁴⁷ He represents an Augustinian interpretation of the work,⁴⁸ and regards demonstration as the means by which fallen human beings, who no longer have direct access to the exemplary forms in God, must first attain knowledge of the sensible world. Thanks to God's illumination of the forms of natural things we may experience their causal activity and recognize them for the universal forms that ground necessary truths—hence Grosseteste's emphasis on induction in *Posterior Analytics* II 19. Real definitions, and mathematical

⁴² Serene (1982), Longeway (2005).

⁴³ See Ebbesen's publication and discussion of the only extant fragment (1977); he doubts the commentary was influential, though Longeway notes that much survived in marginal glosses. See also Bloch (2008). For the earliest reception of the *Posterior Analytics* in the West, and a more detailed analysis of the structure of Grosseteste's commentary, see Dod (1970). De Haas is grateful to Dr Dod for providing him with a copy of his B.Litt. thesis, which regrettably remains unpublished.

⁴⁴ See Minio-Paluello & Dod (1968), which includes Van Moerbeke's revision of James' translation.

⁴⁵ Rossi (1981) with ample introduction; see further Crombie (1953), Serene (1979), Laird (1987), Marrone (1986), and McEvoy (1995).

⁴⁶ Rossi (1978).

⁴⁷ See Bloch (2009) on how Grosseteste interpreted the *Posterior Analytics* as a demonstrative work on the basis of an analysis of I 2.

⁴⁸ See Serene (1982).

proofs that do without final and efficient causes, constitute *demonstratio potissima*. Moreover, Grosseteste distinguishes various degrees of ‘univocal’ subalternation of sciences.⁴⁹

Different views of the nature of reality and cognition, as well as changing demands of the Church, led to different degrees of adoption and adaptation of Aristotle’s views in the commentaries of philosophers such as Albert the Great, Thomas Aquinas, Giles of Rome, Duns Scotus, William of Ockham, John of Cornwall and Walter Burleigh. Most notably, different metaphysical views led to debates on the nature of *demonstratio potissima*, which in turn led to highly sophisticated discussions of detail. Even a short presentation of these discussions would far exceed the limits of this introduction as well as the scope of this volume as a whole, so we will merely give two examples.

Albert the Great, in his commentary, reflects Themistius’ commentary and a lost work by al-Farabi on demonstration (or Averroes’ comments thereon), and thus transmitted other portions of the previous commentary tradition to the Latin world. He objected to Grosseteste’s Augustinianism, and therefore to the latter’s account of subalternation. Instead, Albert restricts the role of mathematics: each science is independent, he maintains, and no particular comes to be as the expression of a higher (mathematical) unity.⁵⁰

Ockham and his followers, in turn, developed their own nominalist version of several notions from the *Posterior Analytics*. In his theory of demonstration Ockham stretches the notion of the universal (*katholou*) to fit his nominalism, tightens the notion of *per se* predication (*kath’hauto*) to match his conviction of the contingency of creatural being, and refines the concept of necessity.⁵¹

Although this introduction of the ancient and medieval tradition of the *Posterior Analytics* is necessarily limited, it does allow the conclusion that Aristotle’s work on scientific method and argument has been a Cinderella for an impressive number of very different households—our task as historians of philosophy is to explain why her dress keeps changing.

⁴⁹ On *metabasis* in the Middle Ages see e.g. Gagné (1969), Livesey (1982, 1985, 1989, 1990), Laird (1983, 1987).

⁵⁰ Longeway (2005).

⁵¹ De Rijk (1990a, 1995).

It will now be clear that this collection of papers addresses three main areas of interest that have occupied students of the *Posterior Analytics* of all times. In Part I the main focus is on the reception of Aristotle's theory of induction and concept formation as represented in *Posterior Analytics* II 19. A recurrent theme is the question whether knowledge of the first principles is in some way innate (as Plato held) or acquired (as Aristotle held); the answers formulated by the ancient interpreters reveal interesting perspectives on the developing notion of science.

Richard Sorabji provides a rich outline of the reception of *Posterior Analytics* II 19 as a theory of concept formation, to be linked to the most challenging chapter on the intellect in Aristotle's *De anima* III 5. In this context the activity of the scientist aiming at grasping first principles is explored through the various models of the mechanics of the human mind (or minds). On Sorabji's interpretation, Aristotle equates experience, or many memories, with rudimentary universal concepts: concept formation takes place through sense perception. For Aristotle, concepts are thus not innate to the soul as Plato held. However, a special ability—the ability of “intellectual spotting” (or *nous*)—is needed to grasp the universal defining feature of a natural kind that is required by a scientist. The ancient commentators, however, neglect Aristotle's discussion of the role of many memories in concept formation, and focus rather on sense perception as a kind of perception of universals, on the role of inductive reasoning, the operations of the different intellects, and on the role of imagination.

Christoph Helmig presents Proclus' criticism of Aristotle's theory of abstraction and concept formation in *Posterior Analytics* II 19 and elsewhere—which is probably the most detailed Neoplatonic criticism of empirically attained concepts that has come down to us from Antiquity. Helmig aims to show that this criticism is first and foremost directed against Aristotle. With Syrianus and other Neoplatonists, Proclus shares the view that mathematical and universal concepts cannot be derived from sensible particulars. Consequently, he rejects the idea that these post-rem-universals (*husterogenes*—lit. “later born” or “of later origin”) are the objects of science (mathematics, dialectic). For Proclus, science is based on innate knowledge and recollection (*anamnesis*). On the other hand, Helmig challenges the widely accepted view that Proclus rejects *husterogenes*-concepts altogether. Rather, in Proclus' works one ought to distinguish between two different kinds of concepts of “later origin”, namely so-called ‘Aristotelian’ concepts (which are empirically derived and hence rejected) and concepts that come into being by means of recollection.

Katerina Ierodiakonou analyses the account of knowledge of the first principles and the distinction between art and science in Eustratius' comments on *Posterior Analytics* II 19, thereby introducing the first known Byzantine commentary on the *Posterior Analytics*. As Ierodiakonou shows, Eustratius, a bishop, uses familiar Neoplatonic features such as the harmonization of Plato and Aristotle and the hierarchy of universals in order to present his own Christian view of the origin of the knowledge of the first principles. Eustratius highlights the perfect creation of soul over and against its imperfect innate status, to which he fits a Neoplatonic epistemology. Moreover, in distinguishing science from art, he defends physics as a science (where science is defined as a cognitive state which is always reliable and as something that requires a demonstration)—perhaps because he wanted to encourage Christians to find out more about God by studying the natural world, which is his creation.

Pia Antolic-Piper first sketches the reception of the Aristotelian model of science in the 12th and 13th century, before launching into a discussion of Roger Bacon's interpretation of *Posterior Analytics* II 19, as can be distilled from his question commentary on Aristotle's *Metaphysics* A. Bacon rejects innatism of knowledge and believes that, because God has created the soul as an empty board, all knowledge instead must be acquired; the *beginning* of knowledge, on the other hand, is innate, since all humans by nature possess the faculties for learning, which are sense-perception and memory. The transition from the senses to the intellect is then characterized as a process of the 'denudation' (which is a kind of abstraction) of forms from their material realization, which provides the intelligible form. The universal terms and propositions that may function as premises in scientific demonstrations, however, are to undergo a more complex procedure: this a special form of induction, which Bacon calls *experimentum*. Ultimately, Bacon's interpretation of Aristotle exhibits his own extreme realism, as well as influences from Robert's Grosseteste's commentary on the *Posterior Analytics*.

Part II of this volume is devoted to the role of the *Posterior Analytics* in the reception and evaluation of Aristotle's metaphysics and its status as a science of being, which would later influence the position of Christian theology towards the sciences.

Maddalena Bonelli shows how Alexander of Aphrodisias presented Aristotle's *Metaphysics* as a science along the lines of the *Posterior Analytics*: it consists of a genus or subject matter, *per se* predicates, and common

principles. This strategy succeeds only if these features are deemed sufficient to define a science, without the need for actual demonstrative argument. On closer scrutiny, Alexander achieves his interpretation of the *Metaphysics* by modifying the notion of *genos* in favour of *koinon* while adding existential overtones, and by employing identity proofs based on semantic relations, which was to become common practice in the Middle Ages.

Angela Longo demonstrates the rather ambiguous reception of the *Posterior Analytics* by Syrianus in his commentary on Aristotle's *Metaphysics*. First, in his comments on *Metaphysics* III and IV, Syrianus makes positive references to the theory of science from the *Posterior Analytics* and uses it to offer his own solutions to Aristotelian problems. However, when commenting on *Metaphysics* XIII and XIV, Syrianus employs selected passages from the *Posterior Analytics* as a weapon against the anti-Platonic negation of the independent existence of mathematical universals that Aristotle endorses there, thus using 'Aristotle against Aristotle'. In short, according to Syrianus, a Pythagorean-Platonic ontology is better served with an epistemology based on a selection of rules from the *Posterior Analytics* than with Aristotle's actual argument in the *Metaphysics*—with the corollary that Aristotle's criticism of Pythagoras and Plato cannot stand up to his own methodology.

The final Part III of this volume is dedicated to the reception of Aristotle's theory of demonstration, definition, and causation as formulated in book II of the *Posterior Analytics*.

Taking a wider perspective of the reception of book II of the *Posterior Analytics*, **Miira Tuominen** analyzes the logic of the *Prior Analytics* I 27–30 as specifically designed to facilitate the discovery of premises for the construction of scientific syllogisms in all four modes. She shows that Alexander of Aphrodisias closely followed Aristotle's prescriptions in his comments on these passages, illustrating each mode by arguments taken from the realm of ethics. Philoponus, who followed Alexander in his examples, also showed himself aware of strategies for selecting premises that satisfy the desired criteria, truth and essential predication for scientific premises and plausibility for the dialectical ones. Both commentators presuppose that the syllogistic schemes set out in the *Prior Analytics* are to be used for both dialectical demonstrations and for strictly scientific ones—of the sort discussed in *Posterior Analytics* book II. Tuominen also suggests that the alleged commonality of the structure of argument forms reflected in the schemes of *Prior Analytics* I 27–30 may explain why the

commentators never saw any discrepancies between Aristotle's theory of science and his practice, as modern commentators do.

Owen Goldin explores the nature and philosophical importance of *Posterior Analytics* II 1–10, where Aristotle discusses the relation between demonstration and definition, through its ancient commentators. Goldin argues that at least some of the ancient commentators, basing themselves (so Goldin claims) on the lost commentary of Alexander Aphrodisias, interpreted *Posterior Analytics* II 1–10 as Aristotle's attempt to explain how explanations through syllogisms grounded in definitional first principles can account for the variety of states of affairs to be explained in the actual sciences. The basic idea on this view is that the nominal definitions of attributes are inherent in the basic subjects of the sciences, and that these inferences can themselves be syllogistically proven on the basis of definitional first principles. A different tradition, however, which is extant in Philoponus(?), takes these chapters to provide an account of how different kinds of scientific syllogisms serve to clarify different aspects of the essence of a kind. Whereas the scholastic tradition has tended to follow Philoponus(?) in its interpretation of *Posterior Analytics* II 1–10, Goldin's own interpretation—which builds on two different senses of *per se*—ultimately sides with Alexander.

Mariska Leunissen turns to the reception of *Posterior Analytics* II 11 in Philoponus. In *Posterior Analytics* II 11, Aristotle introduces his theory of the four causes into the syllogistic framework of scientific demonstrations by asserting that each of the four types of explanation is 'brought out' through the middle term. Contrary to both ancient and modern interpretations, which ultimately all seem to go back to Philoponus, Leunissen argues that Aristotle never intended final causes to act as middle terms in demonstrative syllogisms, but that teleological demonstrations instead 'bring out' how some function or end holds of some subject because some other cause obtains (i.e. the demonstration demonstrates the obtaining of a teleological relationship between two states of affairs through another cause). Philoponus suggestion that the example Aristotle provides to illustrate his assertion about the nature of scientific knowledge (in which the final cause is picked out by the predicate term and not by the middle term) is set out in a confused way and cannot be the true example, thus needs to be rejected.

Finally, **Inna Kupreeva** focuses on *Posterior Analytics* II 12 as a most interesting discussion of causation, where Aristotle comes close to modern views. Having argued for the application of the notion of demonstration to the patterns of causal explanation in II 11, Aristotle raises the

question whether demonstrative validity is preserved in the cases where cause and effect are not simultaneous but are separate in time. His objections against the necessary connection between cause and effect are similar to those raised by Hume, but unlike Hume, Aristotle believes that demonstrative validity can be preserved *if* the syllogism starts with the effect and ends with the conclusion that therefore the cause must have come about first. This type of inference provides logical background to the notion of hypothetical necessity which plays an important role in Aristotle's metaphysics and philosophy of biology, as well as in connection with the role of cyclical transformations in Aristotle's cosmology. Kupreeva introduces a distinction between a 'causal' and 'modal' senses of necessity in analyzing how Alexander and Philoponus reconstructed Aristotle's views on necessity.

In general the commentary tradition on the *Posterior Analytics* displays the sophistication of early discussions of logic and methodology. It is interesting that earlier commentators do not experience the discrepancy between Aristotle's theory and practice which has caused modern commentators so much trouble. We are now in a position to see in ever more detail that the ancient commentators had a significant impact on how Aristotle's philosophy of science was perceived in later ages: as hostile to mathematics, as wedded to an outdated metaphysics, as pagan or useful to (a brand of) Christianity, even as contradictory in itself when it could not be made subservient to a commentator's own aims. If, with the 'advantage' of hindsight, the early medieval adherence to the Aristotelian world view and philosophy of science appears to have constituted an obstacle for the development of science as we understand it today, the collected papers in this volume indicate that, on the one hand, this is mostly due to significant changes to the Aristotelian system by its ancient and medieval commentators. On the other hand, however, it can be maintained that this Cinderella, in her different outfits, did a job from which we benefit even today.

PART I

CONCEPT FORMATION IN *POSTERIOR ANALYTICS* II 19

THE ANCIENT COMMENTATORS ON CONCEPT FORMATION

RICHARD SORABJI

1. INTRODUCTION: ARISTOTLE *POSTERIOR ANALYTICS* II 19

I shall start by saying how I have taken Aristotle's account of concept formation in *Posterior Analytics* II 19, in order to contrast the ancient commentators, who take it quite differently. Aristotle is providing an alternative to Plato by showing how concepts can be formed on the basis of sense perception. There is in that case, he thinks, no need for Plato's alternative, argued in *Phaedo* 72e–77a, of concepts stored in the mind from the soul's existence before birth. In 100a3–8, Aristotle says that many memories of the same type of perceived thing, let us say of oxen, constitute experience (*empeiria*) of oxen. And then, on my interpretation, he uses the word 'or' (*ê*), to equate experience, or many memories, with a rudimentary universal concept of oxen. At any rate, he speaks of experience, or (*ê*) the whole universal (*katholou*) in the soul. Admittedly, the word 'or' can mean 'or rather'. But if he were here talking of experience *or rather* the whole universal, he would have left unexplained the very thing he is trying to explain, how, contrary to Plato's view, remembered sense perceptions are enough to give us at least a rudimentary universal concept. The explanation is that to have a rudimentary universal concept of oxen *just is* to have enough memories of oxen to react with experience to them. It is not a further step beyond many memories.

However, a rudimentary universal concept falls short of the concepts required by an expert or by a scientist. An example that Aristotle has given in *Posterior Analytics* II 8 is that the rudimentary concept of lunar eclipse is that it is *some sort of* familiar loss of light by the moon. It is only the scientist who knows that it is a lunar loss of light due to the earth's shadow. And special ability is needed to recognise this, as he explains in 100b5–12. He here talks of intellectual *spotting*—I believe this is sometimes the force of his talk of *nous*—and rightly says that *spotting* may be what has to happen if we are to grasp the universal defining feature of a natural kind (*APo.* II 19, 100b12; 100b15). He also speaks of

being good at spotting, *ankhinoia* (*APo.* I 34). Reasonably again, he says (*APo.* I 31), that we might spot (*noêsai*) how the burning glass works in all cases, just from seeing light passing through pores in the glass.

Reasoning (*logismos* or *logos*) is mentioned at 100b7 and 10 and reasoning is standardly treated by Aristotle as different from spotting, because it is a process of working something out step-by-step. One kind of reasoning is induction (*epagôgê*), that is, generalising from one or more instances, and this turns out to play a role in concept formation at 100b3, since it is by induction that one passes from individual oxen to the concept of ox (such species are 'primary' and 'without parts'), and thence to the concept of animal in general.

The intervening discussion in 100a14–b5 is part of a restatement that Aristotle offers, on the ground that his initial description of how we form rudimentary concepts was not clear enough. In the restatement, important new ideas are introduced about the contribution of sense perception. It turns out that although one perceives a particular, sense perception is nonetheless, in some sense, perception of a universal. This is true even of a single act of perception without the mediation of many memories. It is not of Callias, the man, but of man. The ancient commentators offer quite plausible accounts of what Aristotle means. But they regard it as his only statement in this chapter of how sense perception contributes to concept formation. They do not regard the appeal to many memories of perceived oxen as having provided an earlier explanation, now to be superseded.

It is sometimes asked whether, when Aristotle talks of universals (*katholou*), here, he is talking of universal propositions or universal concepts. The answer is both. For to have the concept of lunar eclipse is to know a certain proposition, that lunar eclipse is so-and-so. This is not to say that Aristotle is talking of propositions quite generally. I do not agree with Themistius that he is even talking of all scientific generalisations, *In APo.* 63, 15. He is talking about the first premisses of the sciences which supply the definitions of the key concepts.

Let me turn to what the commentators say, after first quoting the passage in Aristotle.¹

¹ Translations are based on those by the following translators, whose names are indicated in the text by initials as follows: Richard McKirahan (RMCK), R.W. Sharples (RWS), Robert Todd (RBT), William Charlton (WC), John Dudley and Koenraad Verrycken (JDud, KV), Jan Opsomer (JO), John Dillon (JD), David Sedley (DNS), Gerald Bechtle (GBe), Frans de Haas (FDH), Glenn Morrow (GM), Charles Hagen (CH), L.G. Westerink (LGW), Richard Sorabji (RRKS). I have also benefited in one of my own translations from that of Harold Tarrant.

(T1) Aristotle *APo.* II 19, 99b35–100b12:

Animals are born with (*sumphutos*) a capacity (*dunamis*) for discrimination (*kritikê*), which is called perception (*aisthêsis*). Granted that they possess this faculty, in some of them the sense image (*aisthêma*) lasts, while in others it does not. Apart from perceiving, those in which it does not last have no knowledge (*gnôsis*) at all, or no knowledge of the things whose perceptions do not last. On the other hand, some animals are able to keep [the image] in their soul after they perceive something. When many occurrences of this sort take place, there is a further distinction (*diaphora*): from the lasting of this kind of things there results in some animals a rational account (*logos*), while in others there does not. Now memory (*mnêmê*) results from perception (*aisthêsis*), as we say, and experience (*empeiria*) [results] from many memories of the same thing, since memories that are many in number constitute a single experience. From experience, or (*ê*) from the whole universal (*katholou*) when it has become stable in the soul—the one beside the many, whatever is one identical thing in them all—[results] a principle (*arkhê*) of art (*tekhnê*) and scientific understanding (*epistêmê*): of art if [the subject in question] is in the realm of coming to be, and of scientific understanding if it is in the realm of what is. So the states are not [innate] in (*enuparkhein*) [animals] in a determinate form nor do they come from higher cognitive states (*gnôstikôteros*), but from perception, as happens when a rout has occurred in a battle, and when one man has stopped, another stops and then another, until it reaches the original position (*arkhê*). The soul is the kind of thing that can undergo this.

[100a14] But let us say again what was just said, but not said clearly. When one of the indiscriminables (*adiaphoros*) has stood still, the first universal is in the soul. (For to be sure one perceives the particular, but the perception is of the universal, for instance of man and not of Callias the man.) Again, a stand is made in these until the things that are without parts (*ameres*) and universal stand still: for example, first such and such an animal, and then animal, and also similarly here. So it is clear that we must come to know (*gnôrizen*) the primary things by induction (*epagôgê*); for that is how perception plants the universal in us too. Since some of the cognitive states (*hai peri tèn dianoian hexeis*) with which we apprehend the truth are always true while others, like opinion (*doxa*) and calculation (*logismos*), admit falsity—while scientific understanding (*epistêmê*) and intellect (*nous*) are always true; and since no other kind is truer than scientific understanding except for intellect; and since first principles have higher cognitive status (*gnôrimôteros*) than demonstrations; and since all scientific understanding depends on a rational account (*logos*)—there cannot be scientific understanding of first principles. And since nothing except intellect (*nous*) can be truer than scientific understanding, it follows that the state that knows first principles is intellect. RMCK

2. THE COMMENTATORS ON DIFFERENT MENTAL FUNCTIONS

Aristotle died in 322 BC. The commentators I shall refer to include Alexander, head of the Aristotelian school in Athens at the end of the second century AD. The others are all Platonists, starting with the Middle Platonist Alcinous in the mid-second century AD, and continuing in sequence with Porphyry in the late third century, his probable pupil, Iamblichus, around 300 AD, Themistius in the late fourth century, in the fifth century the Athenians Plutarch of Athens, Syrianus and Proclus and Syrianus' pupil in Alexandria, Hermias, then in the sixth century Philoponus, Simplicius and Olympiodorus and finally around 1100, Eustratius.²

2.1. *Role of Perception*

Only some of these wrote commentaries directly on Aristotle's *Posterior Analytics*, but those mentioned below discount Aristotle's talk of memories being experience and of experience *or* the universal in the soul. Philoponus(?) *In APo. II*, 436, 2–12, substitutes talk of 'experience and the whole sense image (*aisthêma*)', as if memories did not yet give us a universal concept, but only an image (T2). Eustratius *In APo.* 264, 10–13, takes 'or' in the sense of 'or rather', as if memories and experience were different from the universal concept (T3).³ They think the role of perception in concept formation is not explained until we come to the restatement, according to which perception is perception of the universal.

When Philoponus(?) comes to Aristotle's restatement at 100a14–b5, which, like other commentators he considers the real starting point, he reintroduces his sense image (*aisthêma*) into the discussion and explains quite plausibly (T4 = *In APo. II*, 437, 15–438, 2) that it bears the marks not only of the particular qualities of the person seen, of their being long-haired and pale, but also the marks of the shared characteristics, such as being a rational animal. And all this information is sent along in the first instance to the imagination.

The universal that perception apprehends, according to Themistius *In APo.* 64, 2–9 (T5) and Eustratius *In APo.* 266, 14–29 (T6), is a uni-

² I am glad to have the opportunity of going beyond what I wrote in Sorabji (2004), because that was scattered between vol. 2 (Ch.3, section (g), texts 4–13, and Ch. 5) and vol. 3 (Ch. 5, sec. (c) and Ch. 12 sections (a) and (b)), and it also used only part of the Porphyry passage. Universals, in addition to universal concepts, are discussed in Sorabji (2006), 105–126.

³ For Eustratius see further Ierodiakonou in this volume.

versal not properly separated out from the characteristics of particular instances. Eustratius cites Aristotle's idea from *Physics* I 1, 184b3–5, that a little child at first calls all men 'Daddy', before it separates out the distinctive characteristics of its father.

2.2. Role of Reason

Reason plays a role as well as perception. According to Eustratius *In APo.* 266, 14–29 (T6), when perception confusedly recognises the universal 'human' in the particular, it sends the information along to reason, whereas Ps.-Philoponus, had only told us that in the first instance the information was sent to the imagination. Reason or thought (*dianoia*) is also used, according to Hermeias, *Commentary on Plato's Phaedrus* 171, 8–25 (T7), for the process of assembling (*sunathroizein*) what is common to Socrates and Plato into a universal concept that is then stored in reason. The commentators on Aristotle use a number of words for describing how these rudimentary universal concepts of Aristotle are empirically assembled—*sunageirein*, *sunagein*, *episunagein*, *athroizein*, *sunathroizein*, *sullegein*, *kephalaïousthai*⁴—from the perception of particulars.

2.3. Roles of Different Intellects

In some contexts, I took it above, reason (*logos*) differs from *nous* as step-by-step reasoning differs from intellectual spotting. But the commentators do not take *nous* to refer to spotting in Aristotle's *Posterior Analytics* II 19. They take it to refer to the three or more intellects, which, starting with Alexander, they attribute to Aristotle, on the basis of Aristotle's brief chapter *De Anima* III 5. Alexander distinguishes the three intellects, for example, at *DA* 88, 23–24, and, if this part of the *Mantissa* is by him, at *Mantissa* 107, 21–34 (T8) and 111, 29–32. We have a material intellect (*alias* potential or passive intellect), which gets its proper disposition (*hexis*) from the active intellect (*alias* productive intellect) in us and so becomes the dispositional intellect. The dispositional intellect, according to Alexander *DA* 85, 20–86, 6 (T9), is where we store (*apokeisthai*) our concepts.

⁴ Themistius *In APo.* 64, 24–65, 2; Hermeias *in Phaedr.* 171, 8–25 (Couvreur); Philoponus *in Phys.* 12, 24–28; Philoponus(?) *In APo.* 436, 2–12; Simplicius *in Phys.* 1075, 4–20; Eustratius *In APo.* 266, 14–19. I owe to Christoph Helmig the reference to *kephalaïousthai*, which is in Themistius *In APo.* 64, 16 and to *kephalaïōma*, which is later in Proclus *in Parm.* *Athroismos* is also in Sextus *adv. Math.* 7.224.

But whereas Alexander says in his *On the Soul* (*De Anima*, or *DA* for short), 85, 20–86, 6; 87, 19–21 (T10), that the material intellect can already separate out concepts from matter, in the *Mantissa* he, or the author of that part, says that only the active or productive intellect enables the material intellect to perform that separation (*Mantissa* 108, 19–24 = T11). It does so by constituting an example of a matterless form for reference (*anaphora*). The idea mentioned here of ‘intellect from outside’ is taken from Aristotle *On the Generation of Animals* 736b28: on the baby’s intellect not arising solely from changes within the womb.

The role given to *nous* here is one that Aristotle does not even mention in *Posterior Analytics* II 19: the separation of form from matter. That idea is itself ambiguous. According to Aristotle, in thinking of geometrical figures one thinks of the form (shape) without even *thinking of* the matter in which it is found. But in thinking of objects in nature like a stone, one has to *think of* their matter; it is merely that what one *receives* into one’s mind is only the form of a stone, not its matter (*De Anima* III 8, 431b29–432a1). This is in the first place a theory about what happens when one thinks, and is not expressed by Aristotle as primarily a point about concept formation. But if Alexander sees it in the latter way, he will have made the separation of form from matter a central part of concept formation. Certainly Porphyry treats the separation of form from matter as occurring somewhere in the process of concept formation in the passage to be quoted below.⁵ The initial concept has to be turned into a universal in order that the form may be deposited immaterially in the soul, and this work is assigned to imagination. Themistius and Eustratius in passages cited below⁶ think that separation of the universal from the particular is what is required, because although perception apprehends the universal human, it apprehends it muddled up with the particular characteristics of e.g. Socrates. The role given to *nous* by Themistius, however, is not this separation, but completing the inductive process by recognising that all the cases belong together, first giving the same name to simple things, then combining them into complexes and finally defining them (64, 18–21; 25–26; 65, 15–66, 3).

There are alternatives to Alexander’s view. Themistius *In DA* 98, 35–99, 10 (T12), thinks that the productive intellect turns into universal concepts the imprints which are received from perception and imagination and which are stored in the potential intellect. Philoponus(?) (T13)

⁵ Porphyry *Commentary on Ptolemy’s Harmonics* 14, 10–11 in T14.

⁶ Themistius *In APo.* 64, 2–9 (T5); Eustratius *In APo.* 266, 14–29 (T6).

draws not on Aristotle's chapter on intellect, but on Plato's *Philebus* 39 b, when he says that active intellect inscribes the imprints of all things in the potential intellect like a painter. But in Plato, it was perception and memory that made the inscriptions, and the painter came along afterwards and painted pictures of what had been inscribed.

2.4. Role of Imagination

A role in concept formation was given also to imagination. We have already seen Themistius saying that the potential intellect receives imprints from perception and imagination. And we have seen Philoponus(?) *In DA* likening actual intellect to Plato's painter in the soul. A role in concept formation had already been given by Aristotle's own school to imagination and artistry in the soul, according to Sextus *Against the Mathematicians* 7. 221–222. But Philoponus(?) quoted above from *In APo. II* 437, 15–438, 2 (T4) goes into much more detail about the imagination, which he mentions three times in lines 17, 26 and 30. It is in the imagination that perception imprints an image both of the individuating features of what is perceived (someone's being long-haired and pale) and of the universal features (being a rational, mortal animal).

Porphry goes further still and makes the imagination not just a passive recipient of imprints, but an active ability to add precision to the data of sense. This is in a passage which Harold Tarrant has translated and discussed and considers to be partly drawn by Porphyry from the much earlier Middle Platonist, Thrasyllus (T14).⁷ Porphyry's account starts off in 13, 21–14, 14, echoing Aristotelian ideas to a considerable extent, just as he does also at *in Cat.* 91, 2–5. But he finishes up with Platonist ones. First, using sense perception, the soul tears forms in an Aristotelian way off external matter and draws them into itself. Secondly, a faculty connected with opinion gives a name to the sensory datum and inscribes it in words on the writing tablet of the soul, in the manner of Plato's *Philebus*. Third comes imagination (*phantasia*), which performs a new role of correcting the input, working out an accurate version and storing it in the soul. This is already a concept (*ennoia*). But the universality of the concept is due to the form received being stored in a non-material way. And it seems that imagination performs this function too, of separating the form from matter. When that has been done, one has scientific knowledge (*epistêmê*), but not yet *nous*. *Nous* arises like a

⁷ Tarrant (1993), Ch.5.

light kindled by leaping fire and the scientific knowledge is made firm by *epibolê*, which might be a kind of mental concentration, although Tarrant takes it to be a kind of accumulation.⁸ Neither the spark nor the mental concentration is further explained, any more than Aristotle explains his intellectual spotting, which is also *nous*, and which indeed cannot be further explained. Tarrant conjectures that the confirmation is produced by the assembly of many similar inputs, but one might expect that to have happened, if at all, before the stage of scientific knowledge.

Then after a digression, Porphyry reverts at 15, 1–5, to a much more Platonist account of how the reason (*logos*) within us has a pre-conception of the form received from matter, and uses its previously possessed conception to supplement and correct the received form. This appears to be a second corrective process quite distinct from that carried out by imagination, and based on the prior possession by reason of concepts in a Platonic manner possibly through recollection. The reference to recollection will be Porphyry's own; the earlier stress on imagination may have been due to borrowings from Thrasyllus.

2.5. *Passive Intellect = Imagination*

The role of imagination here might seem to be in competition with the enormous role given by other commentators to *nous*. But in fact, some commentators from Proclus onwards allow a very un-Aristotelian overlap between *nous* and imagination, since they identify passive intellect with imagination. Proclus' reference, in T15, to someone having called imagination passive intellect is probably not to an earlier commentator, but to Aristotle himself, as Proclus interprets him. The equation between imagination and passive intellect is thereafter found in Proclus' pupil Ammonius and in Ammonius' pupils, Philoponus and Asclepius, as well as in Philoponus(?) and Simplicius(?).⁹ The equation cuts across Aristotle's classifications, because in *DA* III 3, Aristotle classifies imagination as a function of perception, not of intellect. It means that to give a role in concept formation to passive intellect is to give a role to images derived from sense perception.

⁸ Tarrant (1993), 128–130.

⁹ Besides Proclus, Ammonius *In Int.* 6, 4–14; 26, 1–2; Philoponus *in de Intellectu* p. 13, Verbeke (CLCAG) *ms.* lines 00–6; Philoponus *In DA* 5, 38–6, 4; 11, 7–11, Asclepius *in Metaph.* 280, 14–17; Philoponus(?) *In DA* III, 523, 29–31; Simplicius(?) *In DA* 248, 6–10. Most are translated in Sorabji (2004).

3. THE PLATONIST COMMENTATORS ON ARISTOTLE: WAS HE RIGHT OR WRONG?

It remains to consider how the commentators handled the disagreement between Plato and Aristotle. For some Platonist commentators wanted to present Plato and Aristotle as in harmony. But Syrianus and Proclus were ready to condemn Aristotle and the condemnation left traces in later commentators too.

3.1. *Recollected Concepts Ascribed to Aristotle*

Some commentators go a long way in assimilating Aristotle to Plato, and make him accept Plato's idea of concepts recollected from the soul's life before birth. This is true of the Neoplatonists Iamblichus, Plutarch of Athens (not the author of *Lives* and *Moralia*) and Philoponus. Thus Plutarch is criticised by Philoponus(?) for thinking that Aristotle agrees with Plato that the intellect of children already has concepts (*logoi*) of things (T16). According to Philoponus, Aristotle's comparison of the potential intellect with a blank writing tablet (*On the Soul* 3.4, 430a1–2) is not a denial that it already contains within the thinkable forms—it does, but it needs them brought to light because of the unconsciousness caused by incarnation (T17). Iamblichus is most explicit of all. Aristotle's comparison of the child's potential intellect with a writing tablet on which nothing is written must be taken to mean only that the writing is faint (T18). Thus Aristotle comes out agreeing with Plato that concepts are within us waiting to be recollected.

3.2. *Recollected Concepts Alongside Aristotle's*

Another less startling view is that Aristotle's empirically gained concepts can be accepted alongside the concepts that Plato postulated as being recollected from the soul's existence before birth. This view is already found in the mid-second century in Alcinous' handbook of Platonism, the *Didaskalikos* (T19–20). Alcinous, like the Stoics, thinks of reason (*logos*) as a collection of concepts (*logoi*). But the concepts gained empirically in Aristotle's manner through sense perception constitute opinative reason (*doxastikos logos*), whereas the concepts recollected from before birth in Plato's manner constitute scientific reason (*epistêmonikos logos*).¹⁰

¹⁰ Brittain (2006) has compared other Middle Platonist texts for acceptance of both types of concept, the *Anonymous Commentary on Plato's Theaetetus*, cols. 23 and 46–48

I have pointed out above that Porphyry also combines an Aristotelian account of concepts being acquired from external matter initially through perception with a Platonic account of reason providing a correction through concepts which it possesses in advance. The acceptance of both kinds of concept is found also in a passage translated above from the *Commentary on Plato's Phaedrus*, 171, 8–25 (T7), of Hermeias, who was Professor in Alexandria. In general, the Alexandrian School stuck closer to Porphyry in philosophy of language, I believe, than did the Athenians.

3.3. Aristotle's Concepts Rejected or Downgraded

A commoner view among the Platonists was that Aristotle's idea of empirically gained concepts is to be rejected. The fact that they are standardly cited in lists of types of *logos*, common feature, or universal, does not mean that they are endorsed. This is very well illustrated in Christoph Helmig's contribution to this volume from Proclus' commentary on Plato's *Parmenides*.¹¹ But the attack is already launched by Proclus' teacher, Syrianus, *In Metaph.* 12, 28–13, 3 (T21); 95, 13–17 (T22); 95, 29–38 (T23), and continued in Proclus' *Commentary on Euclid Book 1*, 12, 9–13, 27 (T24), and thereafter in Simplicius *In Phys.* 1075, 4–20 (T26) and Olympiodorus *Commentary on Plato's Phaedo*, lecture 12.1, lines 9–25 (Westerink) (T27).

The objections to Aristotle's idea that we gain concepts from what we perceive are numerous and Helmig has given a good number of them. Syrianus complains that we do not see every shape, and that the shapes we do see are not precise. If it be replied that they could be made precise, he has a very good answer: how would we know what changes to make except through our possessing precise concepts recollected in Plato's way from before birth? Porphyry had already addressed this problem to some extent in the passage quoted above, but in a way that fluctuates perhaps because of borrowings from Thrasyllos.¹² First he speaks as if imagination could make forms more precise, which simply raises Syrianus' problem how it knows how to do so. But later (15, 1–5), he gives an answer somewhat like Syrianus', that it is reason that adds precision and that it can only do so by first having an exact form within itself. Objections to

and Plutarch *Platonic Questions* 1.4, 1000D–E, and for opinative reason Plutarch *On the Generation of the Soul in the Timaeus* 1024. For opinative reason, A.A. Long has cited Ptolemy *On the Criterion* 18, 12–19, 6; 21, 8–10; Sextus *Math.* 7. 111.

¹¹ See chapter 2.

¹² Porphyry *Commentary on Ptolemy's Harmonics* 13, 21–14, 14; 15, 1–5 (T14).

Aristotle are repeated by all but Ammonius, who has left no writing on the subject, in a chain of teachers and pupils stretching from Syrianus, through his pupil Proclus, to his pupil Ammonius and his two pupils Simplicius and Olympiodorus, and the present objection recurs in Proclus and Olympiodorus. An answer could presumably be supplied by Aristotle's active intellect which, like Plotinus' undescended intellect, resides within us continuously thinking the intelligibles. Had Aristotle wished, he could have made the active intellect the source of precision. But then he would have conceded to the Platonists their main point: the need for concepts beyond those gained empirically.

Proclus is drawing on his teacher, Syrianus when he raises his objections to Aristotle. He complains in his commentary on Euclid (T24) that the geometrical figures we perceive are neither precise nor certain. Precision and certainty have to be added by the soul. Further, there is nothing in the perceptible world which, like geometrical entities, lacks parts, breadth and depth. We do not find there equal radii, fixed ratios of sides, or right angles. (The *Parmenides* commentary adds that we do not see precise triangles). Proclus' *Parmenides* commentary (T25) argues that there is a gap when we generalise by induction from what is true of one or more perceived instances to what is necessarily true of all. How can we know of the necessity, unless we have concepts recollected in Plato's manner from before birth (*In Parm.* 981, 5–9)?

Simplicius (T26) makes the related complaint that there is an infinity of particulars so that universals could not be assembled from them, and Helmig reports this objection from Proclus' *Parmenides* commentary as well.¹³ Olympiodorus, *Commentary on Plato's Phaedo*, Lecture 12.1, lines 9–25 (Westerink), objects (T27) that adding a grain of sand makes no difference to the equality of merely perceptible objects. In comparing degrees of beauty, we must be appealing to some internal concept as a standard. Without internal forms, we could not mentally supply the deficiencies in what we see, nor pass in thought from one thing to another. Finally, the cause of our longing to know precise forms that we do not perceive must be the fact that they are lurking within us.

To look back in overview, it has become clear that the ancient commentators force us to look much more closely at Aristotle's text than we would otherwise do, whether or not we believe their interpretations. They are surely right that very important new information is added by Aristotle

¹³ See p. 40.

when he offers to state his point more clearly. They grapple, as not all modern scholars have, with Aristotle's unprecedented statement that even a single act of perception is of the universal, and they make some plausible sense of it. They add in their own conviction that Aristotle's talk of *nous* must refer to the three kinds of intellect that Alexander read into Aristotle's *De anima* 3.5. They do not accept my suggestion (but neither so far do contemporaries) that Aristotle is only thinking of intellectual 'spotting'. The Platonism of most commentators saw the rationality of humans as permeating their other psychological capacities. Some Platonists, we saw, even identified imagination, in a way that would make Aristotle scream, with the lowest kind of intellect. Our probable disagreement does not prevent us from learning far more from these interpretations than we could if left to our own devices.

TEXTS IN TRANSLATION¹⁴(T2) Philoponus(?) *In APo. II*, 436, 2–12:

‘Or [100a6]’ should be understood as standing for ‘and’. It goes like this: ‘from experience and from the whole sense image (*aisthêma* [but Aristotle says ‘from the whole universal’]) when it has become stable in the soul’ and settled there, comes knowledge (*gnôsis*) of ‘the universal (*katholou*), the one beside the many’, which is something different besides the particulars (*merika*), and ‘is one’ universal ‘in them’, i.e., one and the same thing becomes manifest in all those particulars. Such a universal, which is on the one hand something different besides the particulars and on the other hand is observed in them, comes to be ‘a principle (*arkhê*) of art (*tekhnê*) and scientific understanding (*epistêmê*).’ If this universal is gathered together (*episunagein*) from things ‘in the realm of generation (*genesis*)’, i.e. things that are subject to generation and perishing, it is a ‘first principle’ of art, but if it is ‘in the realm of what is’, i.e., if it is gathered together from things that are always in the same way, i.e., eternal, it is a first principle ‘of scientific understanding’.

RMcK

(T3) Eustratius *In APo.* 264, 10–13:

He meant that ‘from experience’ (*empeiria*) [results] ‘a first principle’ (*arkhê*) ‘of art (*tekhnê*) and scientific understanding (*epistêmê*)’. But since experience is something less complete and insufficient to serve as a first principle of art and science, he added ‘or from the whole universal when it has become stable,’ i.e., when it has come to a stand and is fixed and made firm in the soul.

RMcK

(T4) Philoponus(?) *In APo. II*, 437, 15–438, 2:

Perception acts upon certain particulars, which are undifferentiated in species, and then once and for all implants and imprints this sense image (*aisthêma*) in the imagination which not only bears the marks of certain distinctive (*idiotêtes*) and incidental features, of which the particulars consist (*sunistasthai*) and by which they are recognised, but also takes some mark from the universal. The universal is the common nature which all the particulars have in common. Sense perception sees Socrates and Alcibiades, and takes an impression not only of the particular distinctive qualities (*merika idiômata*) in them (the particular distinctive qualities are one man’s being long-haired and pale, the other not), but also of one of the shared characteristics that it finds in them, that is, their being animals, or rational, or something of that sort. It then sends this along in the first instance to the imagination. When the first sense image is imprinted in the soul, it also creates in the soul a dim knowledge of the universal. Similarly the second sense image and the third and the fourth, being

¹⁴ For the abbreviations referring to the translators see note 1.

alike, and possessing along with the distinctive (*idiômata*) and incidental qualities in the particulars something of the common features in them, get imprinted in the imagination too and also create in the soul knowledge of the universal. For sense perception grasps not only particulars (*merika*), that is, the accidental (*sumbebêkota*) and distinctive qualities (*idiotês*) of which the particulars consist (*ex hôn sunestêkasîn*), but also the universal man, that is, some of the things of which the universal man consists (*sunistasthai*). RRKS

(T5) Themistius *In APo.* 64, 2–9:

For when sense perception perceives Socrates, it simultaneously apprehends human, and when [it perceives] this particular white it simultaneously perceives white. For it does not perceive Callias and man together as entirely the same thing; [if it did,] it would not have called anything but Callias a man. But when it sees Socrates it also sees in him something that is similar and common to other people. And so perception is of the universal too in a way, but not in such a way as to separate (*khôrizein*) it and abstract (*aphairein*) it and know (*gnônai*) it in its own right, but as confused (*sunkekhumenos*) with the particular and rather turned towards it. RMCK

(T6) Eustratius *In APo.* 266, 14–29:

When Socrates is known perceptually, our perception simultaneously apprehends human, though it does not abstract (*aphairein*) human from the particular but confusedly (*sunkekhumenos*) recognises (*gnôrizousa*) human too in the particular. And it is clear that it transmits this to the reason (*logos*) in the soul. (RMCK). For if perception did not recognise human at all, the soul would not be able to move through its own recognition to the apprehension and recognition of human and to assemble (*athroizein*) the universal in itself. But this is what happens to it, so it perceives [human].

[266, 20] And perception is in a way of what is common, even if not as common, but as particular. Or one might say that it is of the particular more as something common than as something particular. For if perception by itself were able to discriminate particulars from each other, it would have been thought to be of them as particulars. But as it is, it encounters them indiscriminately and recognises them confusedly. RRKS

[266, 15] An indication (*sêmeion*) is that children call all men father and all women mother, since they operate (*energein*) only on the level of perception and do not yet possess a disposition that can distinguish (*diakritikê hexis*) the distinctive features (*idiômata*) of each one. And so the perception that perceives Callias does not in virtue of its own capacity (*dunamis*) recognise (*gnôrizein*) him as Callias, but only as a human. RMCK

(T7) *Hermeias in Phaedr.* 171, 8–25 (Couvreur):

‘For the human being must be capable of’ (249b6–7) assembling (*sunathroizein*) by means of reason the later-generated (*husterogenê*) universal (*katholou*) from the common traits distributed in individuals (*apo tôn en tois kathekasta katatetagmenôn koinotêtôn*), i.e. from what is common in Socrates and Plato and the like—for this is what ‘to understand’ (249b7) means. From these [the human being must] project (*proballein*) the universals (*katholou*) that are present in the soul in virtue of its essence, through which as images he will recollect the Forms in the intelligible realm. The animal soul cannot do this, for it is not capable, upon seeing this, that and yet another horse, of assembling in reason the later-generated universal ‘horse’.

FDH

[16] This is so because [the animal soul] does not even possess in virtue of its essence and as innate the concepts (*logoi*) and the substantial universals (*katholou*) of these things. Consequently only the human and the humans’ rational soul can do this, viz. assemble from this and that equal thing which are not precisely equal (for what enmattered thing is precise?) the later-generated universal and precise concept of equal. From these it provides to hand (*prokheirizesthai*) and projects (*proballein*) the universal concepts in virtue of its essence.

Then [the human’s rational soul] from these images (*eikones* [the later-generated universals]) is reminded (*anamimnêskesthai*) of all the forms (*eidê*) in the Demiurge’s Intellect. For neither the soul itself nor things here in the world of coming to be would possess the forms, if the Demiurge’s Intellect had not had them long before, always fixed the same way and having real being.

RRKS

(T8) Alexander(?) *Mantissa* 107, 21–34:

Another [type of intellect] is that which is already intelligising and possesses the disposition of intelligising, and is able to grasp the forms of intelligible things by its own power, being analogous to those among craftsmen who possess the disposition [for their craft] and can perform the actions of the craft by themselves. The first [type of intellect] was not like these, but more like those who are able to take up the craft and *become* craftsmen. And this [second type of intellect] is the material intellect when it has already acquired the disposition and actual intellection. This sort of intellect is in those who are already more perfect and are intelligising. So this is the second [type of] intellect.

[107, 29] The third [type of] intellect besides the two already mentioned is the productive (*poiêtikos*), on account of which the material [intellect] comes to have the disposition, this productive [intellect] being analogous, as Aristotle says, to light. For as light is the cause for colours that are potentially visible of their becoming actually visible, so this third [type of] intellect makes the potential and material intellect [become] intellect in actuality, by creating in it the disposition of intellection.

RWS

(T9) Alexander *DA* 85, 20–86, 6:

The disposition (*hexis*) of this sort is produced in the intellect initially by a transition from the continuous activity over sense objects, with the intellect taking from the sense objects a sort of theoretical vision, as it were, of the universal. At first, the universal is called a thought (*noêma*) or concept (*ennoia*), but once it has grown and become complex and versatile, so that it can do this even without a leg-up from perception, it is by that time intellect. For when through continuous activity it has acquired such a disposition as to be able thereafter to act through itself, then the intellect spoken of as a disposition comes into being. It is analogous to the knower who is between the so-called potential knower and the one who is active as regards knowledge, and who overtakes the potential knower as much as he is thought to fall short of the one who is active as regards knowledge. But when this disposition is active, it becomes the intellect in actuality (*kat' energeian*). For the dispositional intellect is in a way the thoughts (*noêmata*) that are stored (*apokeimena*), assembled and at rest. RRKS

(T10) Alexander *DA* 87, 19–21:

Intellect makes the essence and the forms of composites intelligible to itself by separating them from what accompanies their being. RRKS

(T11) Alexander(?) *Mantissa* 108, 19–24:

This thing that is both intelligible in its own nature and intellect in actuality (*kat' energeian*) is the cause of the material intellect's, by reference (*anaphora*) to such a form, separating and imitating and intelligising each of the enmattered forms as well, and making it intelligible. It is the intellect said to be 'from outside', the active intellect, not being a part or power of our soul, but coming to be in us from outside, whenever we think it. RWS

(T12) Themistius *In DA* 98, 35–99, 10:

As light when supervening on potential sight and potential colours produces both actual sight and actual colours, so too this actual (*energeiai*) intellect advances the potential intellect, and not only makes it an actual intellect, but also constitutes its potential objects of thought as actual objects. These are the enmattered forms and universal concepts (*noêmata*) assembled from particular objects of perception. Up to this point the potential intellect cannot distinguish between them, or make transitions from one to the other, or combine and divide them. Instead like a storehouse (*thesauros*) of concepts, or rather as their matter, it stores the imprints (*tupous*) from perception and imagination through the agency of memory. But when the productive (*poiêtikos*) intellect comes upon it and takes hold of this matter of thoughts, the potential intellect becomes one with it, and becomes able to make transitions [from one concept to another], and to combine and divide concepts, and to examine some on the basis of others. RBT

(T13) Philoponus(?) *In DA* 538, 4–10:

It should be known, then, that actual intellect is said to make all things because it inscribes the imprints of all things in potential intellect. That is why Plato too likens it to a painter [*Philebus* 39 b] and Aristotle straight off proposes that it is a painter [an interpretation of *DA* III 4, 430a1; III 5, 430a15–17]. For if potential intellect becomes all things, actual intellect makes all things. So this can belong to the human intellect. For it is not Intellect from outside that inscribes all things in potential intellect, but actual intellect in us. WC

(T14) Porphyry, *Commentary on Ptolemy's Harmonics*, 13, 21–14, 14 and 15, 1–5:¹⁵

When matter has been given form by the aforementioned rational principle (*logos*), it happens that the soul attends to the entities and as it were tears the forms (*eidê*) again off the matter and receives them into itself and in some way restores them, so that discrimination (*krisis*) can become immaterial. For at first (1) grasping is done by sense perception, which as it were touches the entity and tries to recover the forms and as it were announce them and introduce them into the soul, like a guide, or usher. After that, (2) supposition (*hupolêpsis*, defined by Aristotle *DA* III. 3, 427b25 as including opinion) of the opinative sort (*doxastikê*) receives what has been brought in, names it and inscribes it through words (*logos*) in the soul. The third after this (3) is a faculty that copies the distinctive qualities (*idiômata*) and is genuinely pictorial or plastic, namely, imagination (*phantasia*) which is not satisfied with the form produced by naming and inscribing, but is like those who descry people coming to shore, or who scrutinise matching identity tokens, and work out the exact details of the likeness. In this way imagination also works out (*eklogizesthai*) the entire structure (*morphê*) of the thing and when in this way it makes it exact, then it deposits the form in the soul. And this is the concept (*ennoia*).

[14, 3] When the concept has been installed and firmed up, the disposition of scientific knowledge (*epistêmê*) is installed. From this, like light kindled from a leaping fire, *nous* appears like exact vision for assailing true reality.

[14, 6] The soul began (1) through the grasping and learnt the form embedded in matter, then (2) accepted through supposition that this, the revealed, is the same as what revealed it, and then (3) through imagination worked out by making a copy that the external thing was like the copy. And it (4) passed through the concept to the universal for the immaterial depositing of the form.

[14, 11] After the depositing, scientific knowledge has acquired a firming up through concentration *epibolê* and receives *nous* which concentrates in a pure and then universal state. And that is why there comes to be *nous* of

¹⁵ I have based the following translation on Tarrant (1993) with my own variations.

that of which there is also scientific knowledge and a concept, [that is,] of the form which supplies all the structure to matter. ...

[15, 1–5] But reason (*logos*) by acting in a formal way without matter, finds all that is being discriminated, and as having the form exactly in itself, contemplates [the form of] what is being investigated in a more exact state than it has in perceptible objects. Thence reason also adds what is missing from the form and straightens what is crooked. It could not do that without possessing the form first. RRKS

(T15) Proclus *in Eucl.* I, 51, 20–52, 20:

Imagination (*phantasia*), by virtue of its formative movement and by having its existence along with and in the body, produces impressions that are always particularised and divided and possess shape, and everything it cognises has this kind of existence. That is why someone has not shrunk from calling it passive intellect. Yet if it is intellect, how could it be other than impassive and immaterial? But if its activity is accompanied by being affected (*pathos*), how could it be rightly called intellect any longer? Indeed, impassivity is the hallmark of intellect and the intellectual nature, whereas the possibility of being affected is far removed from a being like that. But in my view he wanted to emphasise its intermediate position between the highest and the lowest types of knowledge, and therefore he called it both ‘intellect’, because of its resemblance with the highest, and ‘passive’ because of its kinship with the lowest. For, on the one hand, cognitions that are without any shape or form contain the objects of intellection within themselves and their activity is self-directed [i.e. directed towards themselves]. They are one with the objects of their cognition and free of any impression or affect (*pathos*) reaching them from the outside. The lowest types of cognition, on the other hand, work through the sense organs, and they are more like affects (*pathêmata*), receiving their information [i.e. knowledge and opinions] from the outside and moving passively along with their objects. Such are sense perceptions, which ‘arise out of violent affects (*pathêmata*)’, as Plato says [*Tim.* 42 a]. JO

(T16) Philoponus(?) *In DA* III, 520, 1–12:

Plato is the person who thinks that the intellect of children is dispositional and has rational accounts of things, not Aristotle. But Plutarch thinks that Aristotle too says this. How can he not be speaking falsely when Aristotle refutes him? He [Aristotle] says that the intellect of children is like a writing tablet on which nothing is written, because it is suitable (*epitêdeios*) for receiving the rational accounts of things but has not already actually received them. Alexander and Plutarch, then, err both severally and together. So now let us say what is true. It should be known that we are of the opinion that intellect is always form. For the intellect of children is form, potentially receptive of forms, and insofar as it is form it is not potential, as Alexander thinks, but insofar as it is potentially receptive of forms it does not have the rational accounts of things, as Plutarch thinks.

WC

(T₁₇) Philoponus in *de Intellectu* pp. 38–40 Verbeke (CLCAG), *ms.* lines 99–43:

[38, 99] But to this it may be replied that we ought to interpret what Aristotle says here carefully and thoughtfully with regard to his whole thought and to what he says everywhere about the intellect. If we have shown a thousand times over, quoting Aristotelian texts, that he wants the rational soul to be separate and immortal, it is plain that even if he here likens it to an uninscribed thing we write on, he does not mean that it has forms in potentiality in the first sense (the sense in which semen is a man in potentiality). But a certain latitude (*latitudo*) must be recognised in both meanings of ‘potentiality’. For we say that prime matter is in potentiality a man, and also the elements and semen and all the things which are in potentiality in the first sense, that is, by virtue of suitability; but they are not in potentiality in the same way but some are closer to the thing and some more remote. A similar latitude, then, must be recognised in connection with potentiality in the second sense, i.e. by way of disposition. Both the sleeping geometer and the one who is awake are said to be [one who knows] in potentiality, but the waking geometer is closer to the actuality; and the geometer who is asleep or drunk because he is held down by sleep or intoxication, resembles the man who does not have the disposition at all. So in the same way even if he says the soul resembles an uninscribed thing you write on, he calls it this because of the holding down of cognition by the passions, which makes it seem as if it did not have forms at all. And when it has already become a knower he still calls it ‘in potentiality’. For he says: ‘When it becomes particular things as one who knows in actuality is said to [even then it is in potentiality in a way]’ [Aristotle *DA* III 4, 429b5–7].

[39, 21] That he means it to be everlasting and immortal he has said plainly before more than once, and he now pronounces it to be separate from all matter. And a little later he again plainly says it is immortal. But these earlier words are sufficient: ‘Concerning the intellect and the contemplative capacity the position is not yet clear; but this seems to be a different sort of soul, and it falls to this alone to be separated as that which is everlasting from that which is destructible [*DA* II 2, 413b24]’. And later he says that just as the sun makes colours which are in potentiality, i.e. colours at night, to be colours in actuality [*DA* III 5, 430a15–17], so intellect which is in actuality, i.e. the teacher’s intellect and the Divine Intellect, makes intellect in potentiality intellect in actuality.

[40, 30] The Philosopher’s meaning is plain from the model itself. Just as the rising sun does not provide existence for the colours, but makes manifest colours which exist there but are not evident, and does not make them to be colours (for they were just as much colours during the night), but makes them visible, so intellect which is in actuality perfects intellect which is in potentiality and brings it to actuality not by putting into it forms which are not there, but by bringing to light forms which are non-evident

and hidden because of the state of swoon which is the effect of birth. And it is this that he calls 'potentiality' in the first sense. For there is a difference between the geometer who is in a cataleptic swoon though he still possesses [knowledge] dispositionally, or who is asleep, and one who is in none of these conditions but is not exercising the disposition; the one has both the disposition and the actuality hidden and is not capable of functioning; the other functions when he wants without being impeded by anything. The intellect which enters the world of becoming is like a person asleep or delirious. WC

(T18) Iamblichus ap. 'Philoponum' *In DA* III, 533, 25–35:

Iamblichus says: 'And see that he says "writing tablet [Aristotle *DA* III 4, 430a1]" and not "sheet of papyrus". For it is not called a 'writing tablet' if it does not have written letters on it. He says this meaning that the souls of children, which are potential intellect, have the accounts of things. So if he likens it to a writing tablet, clearly it has accounts of things, just as the writing tablet has written letters. If he calls it "on which nothing is written", it stands for "ill written" because it has faint, non-evident written letters, as also we say of a tragic actor with a bad voice "He has no voice". So Aristotle too (says he), like Plato, is of the opinion that objects of intellect are in the soul and accounts of all things, and that there is recollection, not learning.' He says this to show that Aristotle too is of the same opinion as he. WC

(T19) Alcinous *Didaskalikos* Ch. 4, 154, 25–29:

This latter [reason (*logos*)], too, has two aspects: one concerned with the objects of intellection, the other with the objects of sensation. Of these, the former, that concerning the objects of intellection, is science (*epistēmē*) and scientific reason (*epistēmonikos logos*), while that concerning sense-objects is opinion (*doxa*), and opiniative reason (*doxastikos logos*). JD

(T20) Alcinous *Didaskalikos* Ch. 4, 154, 40–155, 5:

Opinion is the combination of memory and perception. For when we first encounter some perceptible, and from it we get a perception, and from that a memory, and later we encounter the same perceptible again, we connect the pre-existing memory with the subsequent perception and say within ourselves 'Socrates!', 'Horse!', 'Fire!', etc. And this is called opinion (*doxa*)—our connecting (*suntithenai*) the pre-existing perception with the newly produced perception. DNS

(T21) Syrianus *In Metaph.* 12, 28–13, 3 (Kroll):

Therefore, by saying that there are many ways in which these things [numbers, lines, figures, points] *are*, we bring to light both their being and their substantiality. For even in the sensible works of nature one could see figure, number, physical surface and its limits; in addition, these things are established also in our imagination and opinion, either being grasped by means of abstraction from the sensibles, as he [Aristotle] prefers, or in

our judgement being perfected by the substantial forms of the soul. Thus these things in imagination and opinion (*phantasta, doxasta*) participate in being, but are not substances; that is why they might also fall under quantity rather than quality or any other category; but the substantial concepts (*ousiôdeis logoi*) of soul which contain these things are already substances. But if someone might also see their models in intellect and in the intelligibles, one could view number, figures and magnitude itself as counted amongst the very first substances. GBE

(T22) Syrianus *In Metaph.* 95, 13–17 (Kroll):

But one might wonder at Aristotle who even in these cases of succession puts the universals on the same level as the mathematical; for as the universals are, so the mathematical are, too. In reality both are in the substantial formal principles (*logoi* [concepts]) of the soul but according to him they are in the sensibles and in the concepts (*epinoiai*) which abstract the common natures (*koinotêtes*) from the sensibles. RRKS

(T23) Syrianus *in Metaph.* 95, 29–38:

Generally one should bring against his [Aristotle's] whole theory, both (1) that we have not seen among the sensibles every geometrical shape or every number that the mathematical sciences deal with, and (2) that it is impossible to employ such precision (*akribeia*) on what is grasped from sensibles. If it is claimed that we supplement what is lacking in them and make them more precise and consider them in that condition, it is necessary to state first where the capability to perfect them comes from. We cannot find another more truthful explanation than the one stated by the ancients, viz. that in virtue of its essence the soul has preconceived (*prolambanein*) the concepts (*logoi*) of everything.

Moreover, if we add something to abstractions from sensibles, we shall end up making them not more precise and truthful but rather more fictitious.

FDH

(T24) Proclus *In Eucl.* I, 12, 9–13, 27:

In the first place, if we say that mathematical forms (*eidê*) are derived from sense objects—that the soul, from seeing material circles and triangles, shapes in herself the later-generated (*husterogenôs*) form of circle and the form of triangle—whence come the precision (*akribeia*) and certainty that belong to our concepts (*logoi*)? Necessarily either from sense objects or from the soul. But they cannot come from sense objects, for then there would be far more precision in sense objects than there is. They come therefore from the soul, which adds perfection to the imperfect sensibles and precision to their impreciseness. For where among sensible things do we find anything that is without parts, or without breadth, or without depth? Where do we see the equality of the lines from centre to circumference? Where the fixed ratios (*logoi*) of the sides? Where the rightness of angles? Do we not see that all sensible things are confused with one

another and that no quality in them is pure and free of its opposite, but that all are divisible and extended and changing? How, then, shall we get the stable substance which unchangeable principles have, if they are derived from things that are ever changing from one state to another? For it is admitted that anything which results from changing beings receives from them a changeable character. And how can we get the precision of precise and irrefutable forms (*eidê*) from things that are not precise? For whatever yields knowledge that is steadfast has that quality itself in greater degree.

[13, 7] We must therefore posit the soul as the generatrix of mathematical forms (*eidê*) and concepts (*logoi*). And if we say that the soul produces them by having their patterns (*paradeigmata*) in her own essence and that these offspring are the projections (*probolai*) of forms previously existing in her, we shall be in agreement with Plato and shall have found the truth with regard to mathematical being. If, on the other hand, she weaves this enormous immaterial fabric and gives birth to such an imposing science without knowing or having preconceived (*proeilêphuia*) these concepts (*logoi*), how can she judge whether the offspring she bears are fertile or wind eggs [Plato *Theaetetus* 151 e; 157 d], whether they are not phantoms instead of truth? What canons could she use for measuring the truth in them? And how could she even produce such a varied mass of concepts without having their essence (*ousia*) in herself? For thus we should be making their being (*hupostasis*) come about by chance, without reference to any standard. If, therefore, mathematical forms (*eidê*) are products of the soul and the concepts of the things that the soul produces are not derived from sense objects, mathematical forms are their projections (*proballesthai*), and the soul's travail and her offspring are manifestations of eternal forms (*eidê*) abiding in her. GM

(T25) Proclus *In Parm.* 981, 5–9; 24–41:

In demonstrations and definitions the particular must be entirely subordinate to the universal and the definition. Definitions of common features in particulars do not comprehend the particulars as a whole. (...)

If we are, then, to discover the definition which will serve as the principle of a demonstration, the definition must be of an entity of such a sort as to comprehend everything more particular than itself. Such things are the forms (*eidê*) in us, and not those inherent in particulars. Therefore, if these are abolished, definition will no longer be possible. So the science of definition will disappear, along with that of demonstration, departing from the range of human thought. Furthermore, following on these, the science of division will become a mere name; for divisions do nothing other than distinguish the many from the one, and separate off those things preexisting in a unified manner in the whole into their proper differentiae, not adding the differentiae from without, but viewing them as being within, in the genera themselves, dividing off the species from one another. Where, then, would be the task of this science, if really-existent forms were not present in us? FDH

(T26) Simplicius *In Phys.* 1075, 4–20:

This, then, is the way Alexander explained [it], wishing the universal and the cognition of the universal to be assembled (*sunagesthai*) from the particulars, and he said that it was stated that ‘it somehow knows the particulars through the universal [knowledge]’ as a sign that the cognition of the universal is assembled (*athroizesthai*) by means of the particulars, since the universal knowledge is of each of the things [falling] under the universal (and it has been assembled from these), for the particulars are comprehended in the knowledge of the universal, on the grounds that that [knowledge] comes to be from them and in dependence on them.

[1075, 10] On the other hand, if it is not possible for universals to be assembled (*sunagesthai*) from particulars, since those are infinite, nor for the cognition in the sensory and imaginative [parts] to be capable of bringing scientific understanding into existence in the intellect, [this cognition] being much inferior to [scientific understanding, which is] superior, one must rather, I think, explain in a simpler and truer way what has been stated by Aristotle. The intellect always has knowledge of the universals in actuality (whether ready to hand (*prokheiron*) or not), but of the particulars [only] potentially. Whenever perception strikes the particular, at that time, then, the intellect actually knows (*ginôskei*) the particulars through the universal. ‘For an individual human being is a human being too’, as [Aristotle] himself stated elsewhere [Cf. *APo.* II 19, 100a16–b1] For this reason too he added the ‘somehow’ (*pôs* [247b6. It is not clear whether Simplicius here read Aristotle as saying ‘particulars are somehow known by the universal’ or ‘the universal ... somehow ... by particulars’]), because the cognition of the universal is not on the same level as that of the particular; rather, the particular is known (*ginôsketai*) ‘through the universal [knowledge]’ because the particular is encompassed by the universal. CH

(T27) Olympiodorus *In Phaed.*, Lecture 12.1, lines 9–25 (Westerink):

The second argument is that the approximate must be preceded by the precise (*akribes*), and the vague rough and ready (*amudrês, holoskherês*) by the well-defined, and the forms (*eidê*) in this world are not exact (precise: *akribês*): two magnitudes that are equal will remain so when a quantity the size of a grain of sand is added or removed [74b7–c6]. Since, however, these arguments prove the existence of Ideas (*ideai*) no less than that of concepts (*logoi*) in the soul, let us give some additional proof of the existence of such concepts in the soul. If the human soul distinguishes between forms (*eidê*) in this world and calls the one more beautiful, the other less so, it evidently pronounces these judgements by referring to a certain standard and a certain form; it could not distinguish between things of which it does not have the concepts within itself. We should not believe the Peripatos [Ar., *APo.* II 19, 99b35] when it declares that we discern these things by means of something called the capacity of judgement (*kritikê*): the human soul does not act by mere natural instinct (*phusikôs*), as a spider makes its

web. Besides, if it makes additions and passes from one thing to another, it must evidently have certain forms within itself, otherwise there would be no question of passing on to other things, or of supplying deficiencies, without such forms; a man who sees Socrates' portrait without having seen Socrates before cannot go beyond the portrait. Lastly, if the soul aspires to the knowledge of exact (precise: *akribês*) forms and its aspiration is not in vain, the cause of this longing can only be the presence in it of forms, which it tries to learn. LGW

PROCLUS' CRITICISM OF
ARISTOTLE'S THEORY OF ABSTRACTION
AND CONCEPT FORMATION IN
ANALYTICA POSTERIORA II 19

CHRISTOPH HELMIG*

1. PROCLUS, A NEOPLATONIC STUDENT OF ARISTOTLE¹

Proclus' interest in Aristotle can already be traced back to the time when he studied in Alexandria under a certain Olympiodorus.² As we learn from his biographer Marinus, the Neoplatonist must have been a brilliant student with an exceptional memory.³ For, coming from a lecture, Proclus could literally repeat everything that was said there. What is more, he easily learned by heart all of Aristotle's logical writings,⁴ although these works are, as Marinus underlines, rather troublesome for their readers. Later, after his arrival in Athens, Proclus, together with

* I am much indebted to Prof. Carlos Steel (Leuven) for his comprehensive criticism and constructive remarks on an earlier version of this paper. Moreover, I wish to thank Dr. Guy Guldentops (Leuven) and Prof. Richard Sorabji (London) for important suggestions and corrections. The passages from Syrianus Prof. Sorabji discusses in his article in this volume indicate that a considerable part of Proclus' criticism goes back to his teacher. On Proclus' philosophy in general see now Helmig/Steel (2010).

Since the original version of this contribution was already written in 2004, some years before Carlos Steel's new edition of Proclus' *Commentary of Plato's Parmenides* (OCT, 2007–2009) was published, I am still quoting the text after Victor Cousin's old edition (21864). Nevertheless, I would like to express my indebtedness to Steel's significant editorial achievement that has definitely replaced Cousin's efforts.

¹ Cf. the fundamental remarks by Saffrey (1990), 178–179.

² Marinus, *Vita Procli* §9, 12–17 (Saffrey/Segonds). The reader should also refer to the excellent *Notes complémentaires* by Saffrey, Segonds and Luna.

³ Marinus, *Vita Procli* §9, 25–34 (Saffrey/Segonds).

⁴ Marinus, *Vita Procli* §9, 34–36 (Saffrey/Segonds). The logical writings of Aristotle (τὰ Ἀριστοτέλους λογικὰ συγγράμματα) comprise the whole *Organon*: *Categories*, *De Interpretatione*, *Analytica Priora* and *Posteriora*, *Topics* and *Sophistical Refutations*. Hadot (1987) has investigated the classification of the writings of Aristotle among the Neoplatonists and the order in which they were usually studied; for the logical works cf. *ibid.*, 270–275.

Syrianus, had a close reading of Aristotle's *De anima* and Plato's *Phaedo* under the supervision of Plutarch of Athens.⁵ After Plutarch's death, Syrianus and Proclus even read the whole of the Aristotelian corpus together in less than two years.⁶ Much of the criticism of Aristotle that Syrianus and Proclus share may go back to these discussions.

It is, I think, remarkable that Marinus lays such an emphasis on Proclus' knowledge of Aristotle, while we are comparatively less well informed when it comes to Proclus' studies of the Platonic dialogues, although he must have known most of them, if not all, from memory. One possible explanation is certainly that Marinus wants to show that Proclus' *paideia* was in accordance with the Neoplatonic curriculum where Aristotle was studied as an introduction to Plato. However, it is very unlikely that Proclus would have started to read Plato only after he had read all of Aristotle.

Be that as it may, from the evidence Marinus reports one can safely infer that Proclus' familiarity with Aristotle must have been astounding. Therefore, it is very likely that Proclus composed several commentaries on Aristotle's works. The evidence, however, is so scarce that Beutler in his monographic treatment of Proclus in Pauly-Wissowa's "Realencyclopädie" did not mention a single commentary on Aristotle in his otherwise comprehensive list of extant and lost Proclean works.⁷ This was later corrected by L.G. Westerink, who in the preface to his edition of the *Anonymous Prolegomena to Platonic Philosophy* collected the remains of an *Introduction to the Categories* and of commentaries on *De Interpretatione*, and on the *Prior* and *Posterior Analytics*.⁸ As we have seen, all of these works Proclus had learned by heart as a young student. Moreover, as Westerink points out, there is evidence for a *Commentary on Porphyry's Isagoge*.

That the *Posterior Analytics* were of special interest to Proclus becomes clear from the comparatively numerous instances where the Neoplatonist—directly or indirectly—refers to this work and quotes from it. In the wake of his teacher Syrianus,⁹ it is first and foremost the basis of Aristotle's system of sciences that is criticised by Proclus, and here more

⁵ Marinus, *Vita Procli* § 12, 9–11 (Saffrey/Segonds).

⁶ Marinus, *Vita Procli* § 13, 1–4 (Saffrey/Segonds).

⁷ Beutler (1957), 190–208.

⁸ Westerink (1962), xii with note 22. Cf. also Saffrey/Westerink (1968), lv and Reale (1989), 21 and 129.

⁹ On Syrianus' criticism of Aristotle see now Helmig (2009).

specifically the very foundation of this system, namely Aristotle's theory of concept formation. In the last chapter of the *Analytica Posteriora* it is stated that the starting points of syllogism (συλλογισμός) and scientific demonstration (ἀπόδειξις), which themselves are indemonstrable and immediate, are instilled by means of an inductive process (ἐπαγωγή) that starts from sense perception. Thus, these first principles are ultimately derived from sense perception.

2. PROCLUS, A NEOPLATONIC CRITIC OF ARISTOTLE

For Proclus, as with Syrianus, such a theory is untenable. Although sense perception naturally plays a role in his epistemology, it cannot be the source from which all principles of science derive.¹⁰ True science cannot be based on sense perception. Consequently, the concepts derived from the objects of the senses Proclus terms *hysteroгенê* (ὕστερογενῆ) or later in origin / later-born, thus indicating that they are not prior to the sensible realm—as true causes or principles would be—but derived from it and thus posterior. As will become clear shortly, it is central for Proclus' criticism of Aristotle to distinguish two kinds of *hysteroγενες*-universal. For the Neoplatonist does not deny that we form concepts from sense perception. Compared to Aristotle's account, however, Proclus explains the process in an entirely different way.

Although the term ὕστερογενές in the sense of 'later-born concept' does not occur in Aristotle's extant works,¹¹ Proclus points out that Aristotle refers to it in *DA* I 1, 402b7–8:

¹⁰ In *Alc.* 250, 5–10: "It is clear that the souls do not gather/collect their knowledge from the sensible objects, and they do not find the whole and the one in partial and divided things, but that they project their knowledge *from inside* and correct the imperfect character of the appearances."

¹¹ In Aristotle the term ὕστερογενές occurs several times, mostly in his biological writings, cf. Bonitz' *Index Aristotelicus*. There it carries the meaning "not appearing until after birth" (LSJ s.v. 1). There is, moreover, a passage in the *Metaphysics* (N 4, 1091a29ff.), where Aristotle investigates whether the good and the beautiful are among the first principles: they are either ἀρχαί or ὕστερογενῆ ("appearing after the first principles", N 4, 1091a33). This latter passage comes close to Proclus' use of ὕστερογενές in the context of concept formation, since also for him the later-born universals do not constitute the visible things and are not their causes. They are derived from them and are thus only "appearing after the sensibles". For a collection of passages that illustrate the use of ὕστερογενές in the Neoplatonic tradition cf. Westerink (1977), 165 n. 5.

(T1) In discussing this point Aristotle sometimes says that “animal” is either nothing or a concept of later origin [*DA* I 1, 402b7–8: the Aristotelian text has *hysteron*, which Proclus interprets as *hysterogenes*],¹² and sometimes that it is either nothing or that it exists in the individuals [*APo.* I 24, 85a31].¹³

However, according to Proclus, both possibilities, that is that an ‘animal’ is a concept of later origin or that it exists only in the particulars, are excluded by the Platonic formula *auto kath’ hauto* (αὐτὸ καθ’ αὐτό). This formula, which Plato used to characterise the transcendent Forms, Proclus explains as follows. According to the Neoplatonist, αὐτό distinguishes the transcendent Forms from thoughts/concepts (ἐννοήματα), since a thought always refers at the same time (συναναφέρει)¹⁴ also to its objects, that is it cannot be independent from them.¹⁵ A thought—at least on the levels inferior to intellect—presupposes an object different from itself. As Proclus puts it, a thought is *of* others, in that it has things other than itself as its objects, and it originates from them.¹⁶ Moreover, with *kath’ hauto* Plato, as Proclus explains, distinguishes the transcendent Forms from the Forms in the individuals. These immanent Forms are *in* something else (ἐν ἄλλῳ) and not by themselves. Hence Forms are neither concepts nor are they only immanent in their participants. The passage just quoted clearly shows that Proclus’ criticism of the *hystero-genes* is not directed against a Peripatetic interpretation of Aristotle,¹⁷

¹² It seems that in the manuscript tradition the reading ὑστερογενές does not exist, and it is not very likely that Proclus’ text would have given it. Thus Proclus is not quoting Aristotle literally here, but interprets the Aristotelian text explaining ὕστερον by ὑστερογενές. Likewise Alexander of Aphrodisias, *Quaestio* 1, 11, Themistius, *In de anima* 3, 14–14, 11, and Philoponus, *In de anima* 38, 3 interpret the passage, like Proclus, in a conceptualist manner. Philoponus, for instance, writes: ἔχει [sc. ζῷον] γὰρ τὴν ὑπόστασιν ἐν τῷ νοεῖσθαι, ὡς μέντοι καθ’ αὐτὸ ὑφεστηγὸς οὐδέν ἐστι.

¹³ *In Parm.* II 731, 15–17 (Cousin): περὶ ὃ καὶ ὁ Ἀριστοτέλης διατρέβων ποτὲ μὲν φησι, τὸ ζῷον ἢ οὐδέν ἐστιν ἢ ὑστερογενές, ποτὲ δὲ, ἢ οὐδέν ἐστιν ἢ ἐν τοῖς καθ’ ἕκαστα.

¹⁴ συναναφέρω here means ‘to bring up together with itself’, ‘to refer to at the same time’, cf. *LSJ* s.v. II. It occurs only twice in Proclus, the second passage being *In Alc.* 192, 13.

¹⁵ For the argument that a thought is always a thought of something cf. already Plato, *Parm.* 132b7 ff. The passage is situated in an argument that may be considered the first refutation of conceptualism. For a more recent analysis of the argument see Helmig (2007).

¹⁶ *In Parm.* II 731, 11–12 (Cousin): ἄλλων ὄντα [sc. τὰ ἐννοήματα] καὶ ἀπ’ ἄλλων.

¹⁷ Elsewhere Proclus does not mention Aristotle, but talks about the Peripatetics in general: *In Parm.* III 892, 20–21 (Cousin): Καὶ τοῦτο ἐστὶν ὅπερ οἱ ἐκ τοῦ Περιπάτου φανταζόμενοι τὸ ὑστερογενές εἶδος θρυλλοῦσιν.

but against Aristotle himself. Before I shall turn to Proclus' arguments against Aristotle's theory of concept formation, it is necessary to give a more detailed account of the meaning of *hysterogenes* in Proclus.

3. PLATONIC AND ARISTOTELIAN CONCEPTS

3.1. *Proclus on the Twofold Nature of the Hysterogenes in the Soul*

At first sight, it seems natural to assume that *hysterogenes*¹⁸ in Proclus carries an exclusively negative connotation. In an epistemological context, the word normally signifies something that is 'later-born' or later of origin, more specifically a concept / universal that comes into being in the soul as the result of an 'abstraction' from or a 'collection' of sense-data.¹⁹ In Neoplatonism, such a concept is to be contrasted with the rational reason-principles (λόγοι) in the soul, which the soul possesses from eternity. After every new embodiment, these *logoi* are, however, 'obstructed' due to the troublesome process of the soul's descent and conjunction with a body. Thus, the soul is not conscious of them. Therefore it is the goal of the 'epistemological development / progress' of the soul to become once again aware of these innate reason-principles.²⁰ As can be expected, Neoplatonists like Syrianus or Proclus mostly use *hysterogenes* in a pejorative or anti-Aristotelian sense.²¹ For them it signifies a concept or universal that is exclusively derived from sense perception. It should be noted that this usage of the term is by far the most frequent, and in this sense *hysterogenes* is the object of criticism of both Syrianus and Proclus; in what follows I shall focus on Proclus' criticism.

There is, however, a small number of passages in Proclus and Hermias of Alexandria, where the term is used in a positive, that is, 'Platonic' or

¹⁸ The word occurs in different forms. In what follows I concentrate on the usage of the word in Syrianus and Proclus. One can find τὸ ὑστερογενές used as a noun, but the word also figures as an adjective with words like λόγος, εἶδος, εἰκὼν, καθόλου, κοινόν, νόημα, ἔννοια, φάντασμα. In this sense, it can also signify a specific concept, e.g. ζῶον ὑστερογενές (Proclus, *In Parm.* II 731, 16 [Cousin]) or ὑστερογενὴς ἀριθμὸς (Proclus, *In Tim.* III 26, 18). Moreover, also the adverb ὑστερογενῶς exists, cf. Proclus, *In Eucl.* 12, 13; 51, 5; *In Tim.* III 337, 19 and Eustratius, *In EN* 320, 24.

¹⁹ For these two modes of deriving a concept cf. below in IIIa.

²⁰ Such a process is illustrated by Hermias, *In Phaedr.* 171, 4ff., cf. Helmig (2004), 93–94.

²¹ In Syrianus' *Commentary on the Metaphysics* ὑστερογενές occurs 19 times, but none of these passages betrays a positive usage of the word.

'Neoplatonic' sense.²² Such a usage can best be illustrated by the following texts by Proclus:²³

(T2) The Forms that are more comprehensive, more unified, and more potent causes (αἰτιώτερα) he [sc. Plato] has called genera, saying, obviously, that they are other and different from the forms of later origin (ὑστερογενῇ) and from the forms in the individuals. For these are images (ἰνδάγματα) of the former [sc. of the transcendent Forms].²⁴

(T3) The universals/concepts of later origin (ὑστερογενεῖς [sc. λόγοι]) are images of the reason-principles in the soul, since they are not engendered from the manifold of sensible objects.²⁵

(T4) Moreover, the universal in the many (καθόλου ἐν τοῖς πολλοῖς) is of lesser account than every individual. For, every individual possesses many additions and accidental qualities, whereas the *hysterogenes* comprehends each of the many. That is why it is predicated of each of them and the whole individual is in the universal.²⁶

(T5) This [sc. the *hysterogenes*], therefore, has its being from somewhere else [sc. and not from the sensibles], and it is from elsewhere that it has received this potency of a Form to comprehend each individual. And it is of such a Form that it is an image and it originates in *doxa*, whenever by means of recollection from the sensible things its inner cause [sc. the respective psychic *logos*] is stirred up/awakened.²⁷

All these texts betray a positive attitude towards the universal of later origin (ὑστερογενές), which clearly contradicts Proclus' attested usage of the word elsewhere. How can this be explained? The last three above-mentioned passages stand in an anti-Aristotelian context. They figure as parts of a long argument that claims that the formation of concepts in the human soul cannot be explained without the innate reason-principles. Concept formation presupposes innate knowledge and recollection (already mentioned in T5). This is the fundamental difference to Aristotle, who does not assume the existence of these reason-principles in the

²² For the distinction between Aristotelian and Platonic concepts, I follow Sorabji (2004a), 180–181, Sorabji (2004b Sourcebook Logic), 133–134; 138–139; 142–143, and Sorabji (2004c Sourcebook Psychology), 180–181.

²³ Texts [3]–[5] will be analysed in more detail below (IIc).

²⁴ *In Parm.* II 767, 12–16 (Cousin). I follow Morrow/Dillon here, who translate at *In Parm.* II 767, 14 ἄλλα δὴ τίνα, while Cousin's edition has ἀλλὰ δὴ τίνα. Moerbeke's Latin translation (*alia itaque quaedam*) confirms the translation of Morrow/Dillon. From Steel's new edition it appears that the reading of the mss. is in fact δὴ.

²⁵ *In Parm.* IV 896, 25–27 (Cousin).

²⁶ *In Parm.* IV 894, 4–11 (Cousin).

²⁷ *In Parm.* IV 894, 19–23 (Cousin). For ἀνακινεῖν in the context of recollection cf. already Pl., *Meno* 85c.

human soul. However, Proclus shares with Aristotle the view that our soul *acquires* concepts. Moreover, for Proclus these acquired or derived concepts coexist with the innate reason-principles of the soul. In contrast to concepts that are empirically derived ('Aristotelian' concepts) Proclus has no special technical term for his 'Neoplatonic' acquired concepts. As will be explained in detail below, sometimes he terms them objects of *doxa* in order to distinguish them from φαντάσματα, that is, concepts which are solely derived from sense perception (cf. below in IIa). Proclus can, however, also call them later in origin (ὕστερογενῆ), thus stressing both that they are derived and at the same time more comprehensive than 'Aristotelian' concepts.

In conclusion, whenever Proclus uses *hysterogenes* with a positive connotation to signify derived 'Platonic' or 'Neoplatonic' concepts, he does so against the background of his criticism of Aristotle, who according to Proclus already speaks about the *hysterogenes* in *De anima* I 1, 402b7–8.²⁸ Proclus shares the view that such a Platonic concept is derived and therefore of later origin. In contrast to Aristotle, however, the 'Neoplatonic' concept is not exclusively derived from the sensibles, but is an *image* of the innate reason-principles which comes into being when by means of sense perception the process of recollection is instigated. Thus, although the concept is derived it is not derived from the sensibles, but depends on the innate reason-principles in the soul. Since in both Aristotle and Proclus such a concept is derived, it can—as a 'Neoplatonic' concept—be called a concept of later origin or *hysterogenes*. The same positive usage of *hysterogenes* can be observed in Hermias' *Commentary on Plato's Phaedrus*. At *In Phaedr.* 171, 20 the Neoplatonists contrasts the imperfect sensible things with the universal and precise (ἀκριβής) *logos* of later origin (ὕστερογενής).

In what follows, I shall analyse the different arguments Proclus brings forth to demonstrate that the (Aristotelian) concepts of later origin (1) cannot be the basis for science and knowledge and (2) that a true concept is not derived from sense perception, but that it must be an image of the innate reason-principles in the soul. First, I shall analyse a text from the fourth book of Proclus' *Commentary on Plato's Parmenides* that contains a long digression on the topic.²⁹ Next, I shall compare this text with other parallel texts of the same author, especially with arguments from the

²⁸ Cf. *In Parm.* II 731, 14–17 (Cousin), and above p. 29–31.

²⁹ *In Parm.* IV 892, 31–897, 1 (Cousin). See already Steel (1997). In what follows, I am in many respects indebted to his analysis.

first prologue of his *Commentary on Euclid*. These analyses will provide evidence for the thesis that Proclus' criticism is directed against Aristotle and more specifically against *Posterior Analytics* II 19.

3.2. Concepts Cannot Solely be Derived from Sense Perception

I. The Vague/Faint Nature of the Concepts of Later Origin

Proclus argues that the universal of later origin is more vague / faint (ἀμυδροτέρων)³⁰ compared to the many instances from which it is derived, since it is over / on them (ἐπ' αὐτοῖς) and not before them (πρὸ αὐτῶν).³¹ Note that the description of the abstracted universal as being over a group of instances is taken directly from the first part of Plato's *Parmenides*.³² Proclus' argument implicitly makes use of the principle that every true cause, being ontologically prior, is more potent and more comprehensive than its effect.³³ Moreover, to know a thing is to know its cause. But if the later-born universal is derived from the sensible things we cannot know them by means of it, since it is caused by and depends on the sensibles and not vice versa.

Parallel to this argument, Proclus says at *In Parm.* IV 893, 37–894, 4 (Cousin) that the *hysterogenes* is only over the many (ἐπὶ τοῖς πολλοῖς). According to him, a universal that is abstracted by looking at (ἐπίβλεψις—again an idea Proclus borrows from the *Parmenides*)³⁴ the common element in the many things is just a *phantasma* or a *katêgorêma* (predicate) and only exists because it is predicated of a manifold of things.

³⁰ For this use of ἀμυδροτέρων in the same context cf. *In Eucl.* 14, 21.

³¹ Cf. already Syrianus, *In met.* 101, 2 ff. Considerably later, the argument is repeated by the Byzantine philosopher Eustratius (11th / 12th century AD), *In EN* 320, 21–26: εἰ γὰρ καὶ Ἀριστοτέλης περὶ τὰ ἐξ ἀφαιρέσεως λέγει τὴν μαθηματικὴν καταγίνεσθαι, ἀλλὰ τοῦτο οὐκ ἤρεσκε τοῖς Πλατωνικῶς περὶ τοῦτο δοξάζουσιν, διότι τὰ ἐξ ἀφαιρέσεως τῶν αἰσθητῶν ἐστὶ καὶ φυσικῶν χεῖρονα, ὥς ἐξ αὐτῶν τὴν γένεσιν ἔχοντα καὶ ὑστερογενῶς αὐτῶν ὑφιστάμενα.

³² Pl., *Parm.* 132c3.

³³ Proclus, *Elem. Theol.* § 56, § 60, §§ 70–72.

³⁴ Cf. Pl., *Parm.* 132a3, where Plato uses the phrase ἐπὶ πάντα ἰδεῖν. It is rewarding to quote Waddell's (1894) observation *ad loc.*: “ἐπὶ πάντα with ἰδεῖν does not seem to be a common phrase with Pl[ato]; L. and S. quote *Iliad* XXIII, 143 ἰδὼν ἐπὶ οἶνοπα πόντον.” It seems that ἐπὶ- here has the force of an over-view or a generalisation. It is not a detailed observation but rather a generalisation through sight. The same force of ἐπὶ- can, I think, be found in words like ἐπιλογισμός, for which cf. Plotinus, I 3 [20] 6, 10 ff.

II. *Concept Formation Cannot be Explained Without the Ousiôdeis Logoi in the Soul*

While argument I was of a rather general nature, the following arguments all show that concept formation presupposes the innate reason-principles in the soul (οὐσιώδεις λόγοι). As will become clear as the article proceeds this is the fundamental difference between a Neoplatonic account of concept formation and an empiricist version of concept formation, as it is expounded in the last chapter of the *Posterior Analytics*.

IIa. *Only Human Beings Can Form Concepts—True Concepts of Later Origin (Hystero-genê) are Objects of Doxa*³⁵

Only human beings are able to form concepts, since their souls are rational and they possess the essential reason-principles (οἱ τῶν πραγμάτων λόγοι/οὐσιώδεις λόγοι). Proclus takes as an empirical fact that non-rational animals cannot form concepts, since they only use sense perception, impulses, and imagination (αἰσθήσει χρῆται καὶ ὁρέξει καὶ φαντασίαις).

In what follows, we get a description of concept formation as Proclus sees it. For the Neoplatonist a true 'later-born' concept is not derived from sense perception, but comes into being when by means of sense perception we gain an opinative awareness of the innate λόγοι of the soul. According to Proclus the true concept is an object of *doxa* (δοξαστόν). To describe the process of concept formation he quotes *Phaedrus* 249b–c, a passage that was of central importance to the Neoplatonic interpretation of *anamnêsis* and concept formation:³⁶ "to gather together into one in thought what proceeds from a multiplicity of sense perceptions, and to postulate as prior to the visible and separate individuals the one, identical, and invisible concept/Form (εἶδος)."

This argument makes use of the distinction Proclus draws elsewhere between *phantasia* and *doxa*. While imagination is something a human being shares with all other animals, opinion is already a faculty that discriminates things (κρίνειν). While imagination is the highest faculty of the non-rational part of the soul, opinion stands at the lowest level of reason.³⁷ (I shall return to this distinction below.)

Now, if the human soul observes a common element in the many sensibles, it does not derive this common element from the sensibles

³⁵ In *Parm.* IV 892, 40–893, 24 (Cousin).

³⁶ Cf. Helmig (2004).

³⁷ For the difference between φαντασία and δόξα in Proclus, cf. Lautner (2002).

themselves. It is only able to observe such a *koinon*, *because* it possesses the reason-principles of all things.

(T6) For even as Nature possesses the power of creation of things of sense by having reason-principles within it, and thus moulds and holds together the objects of sense—by the power of the inner eye the outer eye, and the finger likewise and all other parts of the body—so also that which possesses the power of knowing them on the general level, by possessing beforehand the appropriate reason-principles contemplates their common properties.³⁸ [transl. by Morrow/Dillon]

The text neatly shows to what extent epistemology and ontology are intertwined in Proclus' philosophy. The essential reason-principles in the soul are not only the basis for our knowledge of the sensible realm; they serve at the same time as the creative principles of all things. They are handed down from the world soul to nature that produces the whole of sensible reality. And since the human soul has a structure analogous to the structure of the world soul it contains the same reason-principles (*Elem. Theol.* §§ 194–195) by means of which the world soul, via nature, produces all things and maintains their existence.

Moreover, coming back to the above-mentioned distinction between *phantasia* and *doxa*, Proclus states that the common element derived from the sensible things is only a *phantasma* and not an object of opinion (δόξαστόν).³⁹ “It must remain the same, when taken within, as when it was originally apprehended, in order that it may not become false or ‘non-existent’, but it may not become anything more perfect.”⁴⁰ Thus sense perception itself and imagination do not serve as a *criterion* of truth or falsehood for the information gathered from the senses.⁴¹ Imagination is first of all receptive and not able to judge or correct the information it receives. *Doxa*, on the other hand, is able to judge the incoming information it receives from sense perception to a certain extent, since it has access to the essential reason-principles in the soul.⁴² Imagination, in turn, possesses only the capacity to further transform a sense image,

³⁸ *In Parm.* IV 893, 11–17 (Cousin).

³⁹ Cf. also *In Parm.* II 730, 19 (Cousin) and Syrianus, *In Met.* 161, 25–27. Both passages, however, do not draw a clear distinction between φαντασία and δόξα. They describe the abstracted universal as being constituted both by φαντασία and δόξα.

⁴⁰ *In Parm.* IV 893, 20–23 (Cousin); translation Morrow/Dillon. Cf. the parallel in Syrianus, *In met.* 95, 34–38, the text is discussed and translated in Sorabji's contribution, p. 13 and 23, T23.

⁴¹ For the λόγοι as criteria for sense-perception cf. IIb.

⁴² This becomes clear, for instance, from *In Tim.* I 248, 11–13; 249, 8–9 and 292, 26–293, 5, cf. Lautner (2002), 259ff.

but this, according to Proclus, may lead to rather unpleasant effects, since imagination may falsify the sense image or combine, for instance, the image of a goat and a stag in order to produce the celebrated goat-stag (τραγέλαφος), which Proclus groups among those entities that are not.⁴³

IIb. *The Psychic Logoi as Criteria for Sense Perception and the Notion of 'Supplying'*

This category of arguments centres on the weakness and imperfection of sense perception. It is most likely that they were systematically formulated by Proclus in his lost *Commentary on Plato's Phaedo*.⁴⁴ In support of this thesis several arguments can be adduced: first, the basic line of reasoning can already be found in Plato's *Phaedo*, more specifically in the argument from recollection (*Phaedo* 72e ff.). Second, in a passage where Proclus sets out his arguments he explicitly refers to Plato's *Phaedo*.⁴⁵ Finally, in the *Phaedo* commentaries by Damascius and Olympiodorus, we find the two Neoplatonists commenting on the crucial passage in a way that comes close to Proclus' treatment of the material. Both commentaries can be used to clarify Proclus' at times rather minimal account. Such a practice is in accordance with Westerink's theory that both Damascius and Olympiodorus are heavily drawing on Proclus' lost *Commentary on the Phaedo*.⁴⁶

It is one of the recurring themes of the *Phaedo* that sense perception is not reliable.⁴⁷ In the argument from recollection, it is pointed out that the soul must have existed before it entered the body. For otherwise it were difficult to explain that the soul possesses knowledge that it cannot possibly have derived from sense perception or experience (ἐμπειρία). Learning, it is said there with an allusion to the *Meno*, is recollection

⁴³ Proclus' next argument (*In Parm.* IV 893, 24–27 [Cousin]), which is a kind of corollary to the foregoing one, aims to show that soul possesses the essential reason-principles of all things. It is based on the Neoplatonic view, explained above, that Nature contains the principles of all things and produces them. How is it possible, he asks, that Nature produces all things by means of its reason-principles and norms, while soul does not produce with psychic reason-principles and causes. Once again, we see the interconnection between epistemological and ontological arguments. If Nature contains the λόγοι of all things this must *a fortiori* be true for soul, because from a Neoplatonic point of view, soul is prior to Nature.

⁴⁴ For the information we possess about this commentary cf. Beutler (1957), 196; Saffrey/Westerink (1968), lvi; and Westerink (1976), 18.

⁴⁵ *De prov.* 17, 16–22; the passage is discussed below.

⁴⁶ Westerink (1976), 18.

⁴⁷ Cf. Pl., *Phaedo* 65b3–4, quoted by Proclus, *De prov.* 17, 19–20.

(ἀνάμνησις). For where do we get the notion of equality as such (perfect equality) from, if all appearances are imperfect, that is mixtures of equality and inequality? The same holds true for all the other Forms.⁴⁸

Proclus makes it plain that the only way to explain that we, for instance, possess a notion of perfect or pure equality is that it originated from the innate *logoi* of the soul. These *logoi* or reason-principles, which constitute the essence of the soul,⁴⁹ are a reliable criterion (κριτήριο) to judge and correct sense perception.⁵⁰ Since the world soul has produced all things with these reason-principles, knowing the sensibles through the *logoi* means to know them through their causes—which is the Aristotelian requirement for scientific knowledge. The following passages from Proclus' *De providentia et fato* will illustrate the role of the psychic *logoi* as criteria for sense-data.⁵¹

According to Proclus, the rational soul can 'reprove' and correct sense perception, namely information of the kind 'the sun is only one foot long.'⁵² As a rule, sense perception deceives us:

(T7) The rational element in us (ὁ ἐν ἡμῖν λόγος) [...] holds sense perception in low esteem as something that is full of deception, saying "that we do not hear nor see anything certain" [*Phaed.* 65b3–4]. And it speaks these words looking at the inner reason-principles, none of which it knows by means of the body or of bodily cognitions.⁵³

The human soul contains the *logoi* of all things. Moreover, the text implies that the rational soul can *judge* and *correct* sense perception by means of these *logoi*, as was already said above.⁵⁴ The *logoi* are, however, not derived from sense perception, but are innate.⁵⁵ Moreover, by means of the innate reason-principles the soul not only judges and corrects sense perception, it also *adds/supplies* (προσσιθέναι) what the objects

⁴⁸ Pl., *Phaedo* 75c–d.

⁴⁹ That is why they are called essential (οὐσιώδεις), as Steel (1997), 295–296, explains.

⁵⁰ Proclus, *De prov.* 44, 10: *iudicatoria*—κριτήρια.

⁵¹ See now the English translation with commentary by Steel (2007) in the series *Ancient Commentators on Aristotle*. I would like to thank Prof. Steel for drawing my attention to the passages that are discussed in what follows.

⁵² Proclus, *De prov.* 17, 4–5. Proclus uses the example of the width of the sun as a proof for the fact that sense-perception is unreliable also at *In Tim.* I 249, 30 and *In Tim.* I 250, 24. It is already used by Aristotle, *De anima* III 3, 428b3–4 and later by the commentators on Aristotle; see, for instance, Simplicius, *In De Caelo* 186, 12; 548, 21–22.

⁵³ Proclus, *De prov.* 17, 16–22.

⁵⁴ For the judgment/correction of the rational soul, cf. Proclus, *De prov.* 43, 13–15; 17, 4–5 and *In Alc.* 250, 9.

⁵⁵ Cf. Steel (1997).

of sense are lacking (τὸ ἐλλείπον).⁵⁶ The notion of supplying goes back to the commentary tradition on Plato's *Phaedo*, as can be inferred from Olympiodorus' commentary on this dialogue. In the *Phaedo*, it is said that stones and logs are never totally equal. They lack something.⁵⁷ Thus, to arrive at a perfect concept of equality, it is—according to the Neoplatonists—necessary to make the sense-data perfect in thought, to supply what they lack to be perfect. Therefore Olympiodorus writes: “We add what is lacking, since the equal here [sc. among the sensible objects] is not precise.”⁵⁸

IIc. *The Argument from Predication: The Comprehensiveness of the True Psychic Concept*⁵⁹

One of the most intriguing arguments offered by Proclus in order to criticise more empirical forms of concept attainment is the argument from predication. It uses “Aristotle against Aristotle”, pointing out that against the background of his theory of the acquisition of knowledge, his theory of predication no longer works. Proclus' strategy relies on several peculiar assumptions on the nature of predication. First, according to him, what is predicated are not mere words, but psychic concepts. Second, a predicate is supposed to somehow comprehend (i.e., include, in an ontological sense; Gr. περιέχειν) the objects of predication. Aristotle asserts in several passages of his work that ‘man’ or ‘animal’ can be predicated of an individual man such as Socrates.⁶⁰ Proclus retorts that concepts (i.e., predicates) that are derived from sensibles do not comprehend or include the individual objects of predication.

Why is this so? Take the example of Socrates. Apart from being a man, Socrates possesses many other properties by virtue of which he is an individual.⁶¹ Now, according to Proclus, Aristotelian-type predication

⁵⁶ Proclus, *De prov.* 44, 10–11. For the notion of supplying, cf. also *In Eucl.* 12, 19; 13, 5.

⁵⁷ Pl., *Phaedo* 74d–75b.

⁵⁸ Olympiodorus, *In Phaed.* § 12 2,4: καὶ προστίθεμεν δὲ τὸ λείπον, διότι οὐκ ἀκριβὲς τὸ τῆδε ἴσον. The idea can already be found in Iamblichus, *De communi mathematica scientia* 93, 22–24. Cf. also Syrianus, *In met.* 95, 33 and Syrianus, *In met.* 12, 32–33, where he expresses the idea that by means of the reason-principles in soul we can make sense data perfect (τελεῖν), so as to arrive at the notion of e.g. a perfect triangle. The references to Syrianus are discussed in Sorabji's contribution, p. 12–13.

⁵⁹ *In Parm.* IV 894, 4–23 (Cousin). I shall only give a summary of the argument and some parallel passages in Proclus and Syrianus here. The argument from predication is analysed in more detail in Helmig (2008).

⁶⁰ Cf., for instance, Aristotle, *Cat.* 3a18–20.

⁶¹ Cf. *In Parm.* IV 894, 6 (Cousin): προσθέσει γὰρ καὶ συμβεβηκόσι τισί.

does not include all the individual qualities of Socrates. This is so, Proclus argues, because of the origin of the predicate 'man' (i.e. the concept man). The Neoplatonist considers two ways in which the concept man could be attained in an Aristotelian framework. (1) Suppose that the predicate in question is derived from the *common element* in the many individuals (in our case: man).⁶² Proclus notes that this would not work, since the predicate cannot be more comprehensive than the things from which it is derived. Hence, if it is derived from the *common element* in things, it will only comprehend the property "being a man", but not the many other properties and characteristics that make up an *individual* human being.

(2) Suppose that the predicate is derived from the many particulars themselves. Proclus discards this possibility by invoking what may be called a stock argument against induction.⁶³ As said before, in order to be truly comprehensive, the predicate would have to include all individual human beings with their respective properties and characteristics. However, this would imply that the concept (i.e., predicate) had to be derived from all the actually existing human beings, which is hopelessly impractical. As Proclus puts it, it is impossible to see the infinite number of men, to all of which we apply the same predicate. This is to say that a 'complete induction' would fail, because one cannot possibly go over all the individual human beings. This is even more true of individual human beings that are not yet born or that have already died.

All this does, of course, not mean that Proclus would abandon predication altogether. Rather, he claims that his theory of concept attainment provides a way out of the dilemma he believes to have discovered in Aristotle. His argument is of an ontological character and runs as follows. According to Proclus, a certain type of psychic concepts (i.e., predicates) come into being by means of recollection. These concepts, as we learn from the text, are not abstractions (i.e., derived from sensible particulars), but images of the innate knowledge (the innate *logoi*) of the soul. Since these concepts *qua* being images are *derived* from and hence *posterior* to the innate psychic *logoi*, Proclus can call them 'of later origin'

⁶² *In Parm.* IV 894, 17–19 (Cousin). The argument that a psychic concept cannot be derived from the common elements in the many sensibles is also made at *In Parm.* IV 893, 27–894, 4 (Cousin). There it is said that such a theory would make matter more perfect than the soul. Cf. the close parallel *In Eucl.* 14, 24–25: "Ἐτι δὴ τὸ τρίτον λέγομεν, ὅτι καὶ τὴν ψυχὴν ἀτιμωτέραν ποιοῦσι τῆς ὕλης οἱ τὰῦτα λέγοντες. The whole argument goes from *In Eucl.* 14, 24 to 15, 15.

⁶³ See Helmig (2008), 41 note 44, for a collection of parallel passages from other Ancient authors.

(ὑστερογενῇ). He says, moreover, that these concepts are objects of *doxa* (δοξαστά).⁶⁴ Note that in Proclus' argument the positive or Neoplatonic use of the concept 'of later origin' plays a crucial role. The text is one of the main passages that I have used above (3.1) in order to argue that *hysterogenes* has two meanings in Proclus.

But why can Proclus claim that this Neoplatonic concept comprises or includes all individuals that fall under it? The argument hinges on a crucial assumption of Neoplatonic ontology, namely that principles that are of a higher ontological order comprehend (περιέχειν) the things that come after them. Because of this Proclus can argue that the psychic *logoi* contain all the properties that distinguish one individual from another *in act* (see *In Parm.* V 981, 20–24 [Cousin]). The same holds true for the Neoplatonic concept "of later origin", since it is an image of the psychic *logos*. Hence, in contrast to an Aristotelian-type abstracted concept, this concept can serve as a predicate, because it comprehends all the individuals that fall under it, or, as Proclus puts it, the *whole* individual, that is, with all its individuating properties, is in the universal.⁶⁵ From a Neoplatonic perspective, the argument works, because (a) the psychic *logoi* in the world soul/nature are the causes of the sensible individuals and because (b) the human and world soul contain the same *logoi*. According to Proclus the essential reason-principles (οὐσιώδεις λόγοι) in the soul figure at the same time as principles of all things which Nature produces

⁶⁴ *In Parm.* IV 894, 22 (Cousin). Although Cousin's text gives παρὰ δόξαν ὑποστάν (*In Parm.* IV 894, 22), which Morrow/Dillon render as "has a paradoxical status", in Steel's new edition the text reads περὶ δόξαν ὑποστάν (in accordance with Moerbeke's Latin translation: "circa" [= περὶ]). Elsewhere too Proclus asserts that the Neoplatonic "later-born" universal is a δοξαστόν (*In Parm.* IV 893, 20 [Cousin]). As far as the reading παρὰ is concerned, it is not easy to see why Proclus would describe the status of such a concept as "paradoxical". Moreover περὶ is certainly the *lectio difficilior*. It can be assumed that a scribe changed περὶ δόξαν into the more familiar phrase παρὰ δόξαν. For a parallel of the rare expression "περὶ δόξαν" cf. Platon, *Philebus* 59a1: τὰ περὶ δόξαν [sc. the objects of δόξα] ζητοῦσι.

⁶⁵ Read ὅλον ἐν for ἐν ὅλῳ (*In Parm.* IV 894, 9 [Cousin]). From the parallel passage *In Parm.* V 981, 11 ff. (Cousin), one expects that Proclus wants to say here that the *whole* of the individual is in the universal and not vice versa, but there is no evidence in the manuscripts or in the Latin translation of Moerbeke for such a reading. Nevertheless, the emendation seems necessary. One should therefore write καὶ ὅλον ἐν τούτῳ τῷ καθόλου τὸ καθέκαστον instead of καὶ ἐν ὅλῳ τούτῳ τῷ καθόλου τὸ καθέκαστον (Cousin), since the reading of the mss. hardly makes sense. In the new edition of the Greek text by C. Steel my emendation has been accepted.

after having received these *logoi* from the world soul, and also as principles of knowledge in the soul of the world and the human soul. And since the human soul is an image of the soul of the word (cf. Pl., *Tim.* 41d), the human soul contains the same *logoi* as the world-soul and as Nature.⁶⁶

Let us now turn to two parallel passages (from Proclus and Syrianus) that confirm the interpretation given above. The first text is taken from the fifth book of Proclus' *Commentary on Plato's Parmenides*.⁶⁷ It is situated in a longer argument that aims to show that universals that are derived from sensible objects cannot form the basis of the science of dialectic. Dialectic is only possible because of the soul's innate knowledge (λόγοι). Proclus constructs the present argument along the same lines as the argument from predication. If, he argues, a definition were based on the common element in the individuals (i.e., immanent form), it would not comprehend the individual as a whole. For an individual (such as Socrates) is more than a mortal animal possessing reason (i.e., definition of human being), since *qua* individual it differs from other members of the same species. Although concepts of later origin (ὑστερογενῆ) are not mentioned explicitly here, it is plain that if definitions cannot be of immanent forms, they can *a fortiori* not be of concepts that are derived from these common elements.

Apart from the passage in the fifth book of Proclus' *In Parmenidem* there is a strikingly similar argument in Syrianus' *Commentary on the Metaphysics*.⁶⁸ As with the former argument from predication, Syrianus asserts that we cannot predicate the animal in things (i.e., the form in matter) of the *whole* of an individual man (πᾶς ὁ ἄνθρωπος),⁶⁹ because the enmattered form of animal does not comprehend the specific differences "rational", "capable of laughter", and "mortal". The reason is that

⁶⁶ Cf. also *Elem. Theol.* §§194–195, where it is said that *all* souls contain the λόγοι of the sensible things. Therefore, when the human soul knows the things in the world through its (sc. the soul's) λόγοι, it knows them by means of their causes and has thus scientific knowledge of them in an Aristotelian sense (cf. e.g. *APo.* II 8, 93a3–4).

⁶⁷ *In Parm.* V 980, 29–981, 31 (Cousin). The argument is briefly analysed by Steel (1984), 13–14. See also Helmig (2008), 46ff.

⁶⁸ Syrianus, *In Met.* 161, 14–20. See my comments in Helmig (2008), 48–49.

⁶⁹ In their recent English translation of the text, J. Dillon and D. O'Meara translate "every man". However, if we take into account the parallel passages in Proclus, the sense ought to be "the whole man". For there are no differences between single men regarding the fact that they are mortal, capable of laughter, and rational. In Helmig (2008), 48, I have quoted the translation by Dillon/O'Meara, although it does not match my reading of the passage.

brutes, human beings, and gods (which are also considered animals)⁷⁰ share the same immanent form. As with Proclus, Syrianus too asserts that only the psychic *logos* of animal comprehends all these specific differences.

IId. *The Argument from Scientific Demonstration* (ἀπόδειξις)⁷¹

Every scientific demonstration takes its start from principles that are prior, more perfect (τελειότερον), and more universal. But how can a universal fulfil these requirements, if it is a universal of later origin? This argument can already be found in Syrianus.⁷² It uses, once again, “Aristotle against Aristotle.” For Proclus employs Aristotle’s remarks about the nature of the universal (καθόλου) in the *Posterior Analytics*, as being prior, valuable (τίμιον) and eternal,⁷³ in order to show that the Stagirite contradicts himself, when he maintains that the universal is a universal/concept of later origin.⁷⁴

How, Proclus asks, can a universal be prior or more valuable if it is a later-born universal? With later-born universals, that which is more universal is less essential, because the same is true for the individuals from which it is derived. A human being, for instance, shares being an animal with all other animals, but his specific essence consists in the fact that he is a human being, a rational animal. Hence, the species (as a concept of later origin)—as with the individual from which it is derived—had to be more essential than the genus, which—from a Neoplatonic point of view—is absurd. One would, therefore, do away with the principles of the truest scientific proof if one claimed that the later-born universals are the true universals in the soul, because they are not more powerful than the things that are more particular (the individuals), not their causes, and not prior according to nature.

⁷⁰ Helmig (2008), 48–49 note 80.

⁷¹ *In Parm.* IV 894, 24–34, cf. *In Eucl.* 13, 27–14, 23.

⁷² Cf., e.g., Syrianus, *In met.* 161, 8. ff.

⁷³ The relevant passages from the *Posterior Analytics* are listed by Steel (1984), 12 note 21–22.

⁷⁴ Cf. the parallel *In Parm.* III 796, 14–797, 3 (Cousin). That for Proclus every true demonstration presupposes the psychic reason-principles is pointed out by Steel (1984), 10–13. The criticism of Syrianus and Proclus might well be directed against Alexander of Aphrodisias, who may be taken to say in *Quaestio* 1, 3 that the definition is of the common element in the things or of thoughts (i.e. abstracted universals). Cf. already Aristotle, who in *Met. Z* 11, 1036a28–29 states that the definition is of the universal (καθόλου) and the form. According to Frede/Patzig (1988), 51, καθόλου and κοινόν can be used interchangeably by Aristotle.

This argument is another clear piece of evidence that Proclus' criticism is directed against Aristotle and, more specifically, against his *Posterior Analytics*, where Aristotle's theory of demonstration (ἀπόδειξις) and more of the starting-points of demonstration (*APo.* II 19) are laid down.

Ile. Some Concepts Cannot Technically Be Derived from Sense Perception

The true concept in the soul must be an image of the essential reason-principles, because we possess some concepts that cannot possibly be derived from sense perception.

(T8) We must, then, as I have said, ascend [...] to the reason-principles in Soul, and not only to the "later-born", but also to the essential ones. The "later-born", after all, are images of these latter, not sprung from the sensible particulars. For it is not the case that there is a common element/principle (τὸ κοινόν) of all multiplicities: [A] we do not after all postulate universal principles (τοὺς καθόλου λόγους) of evil things; [B] the same holds true in the case of unique things [e.g., sun and moon], because with unique things we decline to observe a common property. It is from within, then, and from our essential nature, that the projections of the Forms arise, and not from sense-objects.⁷⁵

As was already said, the point Proclus wants to make here is that there are at least some later-born concepts which could not originate from sense perception. And this shows that they must come from somewhere else, that is, as Proclus points out, from the innate *logoi* in the soul. The reason is that we have some concepts in our soul that could not possibly be derived from sense perception. The examples are evils and unique entities like sun and moon. We can presuppose from what was said above that abstraction from the sensibles only works if one can observe a *common element* in a manifold of things. However, according to Proclus in the case of evil and unique things (e.g. sun and moon) such common element does not exist. This goes without saying in the case of sun and moon, because a "common element" presupposes more than one entity that shares it. That is why already Aristotle claimed that there can be no definition of sun and moon.⁷⁶ With evil things this is not so obvious. Of course, we know what evil is, we have a concept of evil and we can talk about it.⁷⁷ On the other hand, the Neoplatonists refused to posit a

⁷⁵ *In Parm.* IV 896, 22–33 (Cousin); translation by Morrow/Dillon, slightly modified.

⁷⁶ Cf. Aristotle, *Met.* Z 16, 1040a27–29. The same holds true for Platonic Forms, also they are not definable, cf. Aristotle, *Met.* Z 16, 1040a8ff. and Steel (2003), who analyses Proclus' discussion of the problem as to whether Forms can be defined.

⁷⁷ Prof. Sorabji rightly points out to me that the passage does not say that concepts of

transcendent Form or a reason-principle (λόγος) of evil. For them, evil only has a parasitic existence, it is a mere *parhypostasis*.⁷⁸ That implies that there cannot exist a common element or immanent universal of evil (κοινόν)⁷⁹ in sensible things. And that, in turn, implies that we cannot form a later-born universal of it.⁸⁰ But although we cannot form a “later-born” universal of evil, we can nevertheless, as Proclus explains, know what evil is by means of the universal *logoi* in our soul. And this, in turn, explains why we possess a concept of evil:

(T9) If there are various other things which we define of which Forms do not exist, such as artificial objects, parts of things, and evil things, there is no cause for astonishment here; for it is by virtue of the fact that we have within us reason-principles of all natural entities and good things, that we know also such things as complete (συμπληρωτικά) the totality of the whole entities [sc. parts], or imitate Nature [sc. artefacts], or arise as by-products of good things [sc. evils]. According to the mode in which each of these things exist, so they are knowable and definable to us, and we discourse about them on the basis of the definitively established reason-principles within us.⁸¹ [transl. by Morrow/Dillon, slightly modified.]

Proclus argues that the fact that we possess reason-principles in our soul does not mean that through them we can only know entities of which we possess the corresponding *logoi*.⁸² I shall exemplify this theory

evil etc. do not exist. That would contradict the evidence. All Proclus wants to say here is that these concepts cannot be derived from sense-perception.

⁷⁸ Cf. Opsomer/Steel (2003), esp. 23–28.

⁷⁹ Proclus' argument leaves out the implicit inference that if there are no καθόλου λόγοι of evil in the world soul or in nature and therefore no causes of evil, there can be no immanent universal (κοινόν) of evil in the things. For κοινόν in the meaning of immanent universal cf. below II d.

⁸⁰ The argument from evils is, however, slightly problematic, for elsewhere Proclus is prepared to concede that there is a common element of ugly things, although he would not assume καθόλου λόγοι of ugly things. Cf. below II f.

⁸¹ *In Parm.* V 986, 37–987, 8 (Cousin): εἰ δὲ καὶ ἄλλα ἅττα ὀρίζομεθα ὧν μὴ ἔστιν εἶδη, θαυμαστόν οὐδὲν, οἷον τῶν τεχνητῶν ἕκαστον καὶ τῶν μορίων καὶ τῶν κακῶν τῷ γὰρ εἶναι τοὺς λόγους ἐν ἡμῖν τῶν τε ὄλων καὶ τῶν κατὰ φύσιν ὄντων καὶ τῶν ἀγαθῶν, καὶ ταῦτα γινώσκουμεν, ὅσα ἢ συμπληρωτικά τῶν ὄλων ἔστιν, ἢ ὅσα μιμεῖται τὴν φύσιν, ἢ ὅσα παρφυρίσεται τοῖς ἀγαθοῖς· ὥς γὰρ ἔστιν ἕκαστα τούτων, οὕτω καὶ γνωστά ἡμῖν ἐσσι καὶ ὀριστά, καὶ διαλεγόμεθα περὶ αὐτῶν ἀπὸ τῶν ἐν ἡμῖν ὀρισμένως ἐστῶτων λόγων.

⁸² The list of entities Proclus gives here contains items that do not correspond to reason-principles in the soul: parts, artefacts and evils. In other passages he argues that these are entities of which no transcendent Forms exist. Roughly speaking the λόγοι in our soul are copies of the transcendent Forms, but there are, apparently, also exceptions. A prominent one is the question whether a transcendent Form of hair exists. As we learn from *In Parm.* III 835, 37–38 (Cousin), although no transcendent Form of hair exists,

with a discussion of the problem of whether we are able to know evil.⁸³ At first sight, it seems that evil cannot be known, since every piece of knowledge is the apprehension of a Form, and evil has no Form, but is like a privation.⁸⁴ This would mean that even the gods cannot know evil and that they are not omniscient. However, according to Proclus, the gods know evil by means of its contrary or qua good (boniformiter, ἀγαθοειδῶς).⁸⁵ And they can do so because evil is never pure evil, for “if evil were unmixed evil and only evil, it would be unknowable for the gods.”⁸⁶ Accordingly, we can, I think, understand how the human soul knows things of which it does not possess reason-principles by means of these very reason-principles.

IIf. A Difficulty: The Problematic Origin of the Concepts of Ugliness and Evil

In Proclus' *Commentary on Plato's Republic* we find an argument that seems to contradict his reasoning in the *Commentary on Plato's Parmenides*. At *In Remp.* I 260, 21 Proclus explicitly says that the *hystero-genes* of ugliness (τὸ αἰσχρόν) originates strictly from below (κάτωθεν). How do we have to understand this statement? At first sight it seems to be in conflict with what Proclus says at *In Parm.* IV 896, 22–33, namely that the concept of evil cannot originate from below, that is, from sense perception, since evil does not have a common element (κοινόν) or a form-in-matter from which we could abstract a notion of evil. How can we solve this difficulty?

In the passage in question, Proclus tries to show that a transcendent Form of ugliness does not exist. He is urged to explain this somewhat at length, because Plato at *Republic* 476a mentions a Form of injustice

Proclus assumes nevertheless the existence of a reason-principle (λόγος) of hair. At *In Parm.* IV 893, 10–15 (Cousin) λόγοι of eye and finger are mentioned. But nowhere in his extant writings the Neoplatonist would systematically describe the different extensions of transcendent Forms and λόγοι. Cf. already Plotinus V 9 [5] 12, 5–11, where he probably alludes to λόγοι of certain forms of noses as well as of certain colours.

⁸³ In what follows I am indebted to the excellent notes 304 and 357 in the English translation of *De malorum subsistentia* by Opsomer/Steel (2003).

⁸⁴ Cf. Proclus, *De mal. sub.* 51, 3–4 and Plotinus I 8 [51] 1, 9ff., who discusses the same problem. That knowledge is knowledge of a form is formulated by Aristotle, *DA* III 8, 431b29–432a3, and also in Plato this goes without saying.

⁸⁵ Cf. Proclus, *De mal. sub.* 61, 17–20; 42, 20 and 51, 5–6. The notion that evil is known by means of its contrary goes at least as far back as Aristotle, see *DA* III 6, 430b22–23. Moreover, Opsomer/Steel (2003) refer also to Philop., *On Aristotle on Intellect* 82, 27–31.

⁸⁶ Proclus, *De mal. sub.* 42, 12–13.

(εἶδος ἀδίκου) and a Form of evil (εἶδος κακοῦ). Solving this exegetical difficulty, Proclus argues as follows.⁸⁷ Suppose we would only make a distinction between divisible things and Forms. We would be urged to admit also a Form of ugliness. For, we could single out a common element of ugliness alongside the many ugly things (τὸ αἰσχρὸν ἐν τι παρὰ τὰ πολλά). However, a transcendent Form of ugliness does not exist. Therefore, we have to add another element to the initial bipartition. Between the divisible things and the transcendent Forms there is also that which is in the divisible things (ἐν τοῖς πολλοῖς). This allows Proclus to characterise the phenomenon “ugliness” more precisely:

(T10) Ugliness is in the individuals according to a declension from the transcendent Form/Idea, and it is (only) a so called Form as being common to a manifold of things. Or it is in the souls as being a later-born thought.⁸⁸

From the whole reasoning in the *Republic Commentary* it becomes clear that Proclus is very careful not to identify this so called form (λεγόμενον εἶδος) of ugliness with a Form in matter.⁸⁹ It is not a form qua being a Form in matter, it is only a form qua being common to a manifold of sensible things. The form of ugliness only exists as a *declension* (ἀπόπτωσις) from the transcendent Form.⁹⁰

But the basic difficulty, nevertheless, remains. At *In Parm.* IV 896, 22–33 (Cousin) Proclus claims that one cannot form a concept of evil from sense perception, since there is no καθόλου λόγος and therefore no common element (κοινόν) of ugliness. At *In Remp.* I 258ff. we read that the ὑστερογενές of ugliness comes strictly from sense perception (κάτωθεν). One way of solving this contradiction can probably be found in the meaning of κοινόν. It can be shown that Proclus at times uses κοινόν as a synonym of ἐνυλον εἶδος (Form-in-matter). He does this, for instance shortly before our passage at *In Parm.* IV 893, 38 (Cousin).⁹¹

⁸⁷ Proclus, *In Remp.* I 260, 14–18.

⁸⁸ *In Remp.* I 260, 19–21: ἐν τοῖς καθ' ἕκαστα κατὰ ἀπόπτωσιν ὑποστάν [sc. τὸ αἰσχρὸν] τῆς ἰδέας, καὶ εἶδος [ἄν] λεγόμενον ὡς πολλοῖς κοινόν, ἢ ἐν ταῖς ψυχαῖς ὡς νόημα ὑστερογενές.

⁸⁹ Cf. *In Remp.* I 260, 8–12, where the Neoplatonist points out that even the Form in the things is still a Form and that it carries the main characteristics of a Form. Forms are always one and the same—they never change.

⁹⁰ Another expression Proclus frequently uses to signify the same fact is ὕφεσις.

⁹¹ The equation of common element (κοινόν) with the form-in-matter (ἐνυλον εἶδος) seems *inter alia* to be implied in the expression that the common element “holds the individual together” (*In Parm.* IV 893, 38 [Cousin]).

If we take the argument from the *Parmenides Commentary* and suppose that *koinon* means Form-in-matter, the argument is sound, given the Neoplatonic premise that there is no *enhylon eidos* of evil, and given that abstraction really presupposes a Form-in-matter. Broadly speaking and with a few exceptions, there are as many types of Forms-in-matter as there are transcendent Forms/Ideas. And since a Form of evil or Forms of parts do not exist,⁹² there are no corresponding common elements in the things. Thus Proclus' whole argument is based on ontological premises.

In the passage from the *Republic Commentary* κοινόν cannot, as we have seen, be equated with a Form-in-matter. It is rather a common element derived from the things by our soul or, as Proclus himself calls it, a ἐν παρὰ τὰ πολλά. The problem is that here Proclus claims that we can derive a concept (ὕστερογενές) from such a common element, whereas in the other passage he would strongly contest such a possibility. Without a common element, understood as Form-in-matter, no concept can be formed. Not every common element that we observe in a manifold of similar things already presupposes a transcendent Form or a *logos* in nature (καθόλου λόγος) that corresponds to it.⁹³

Thus, we can conclude that argument 1 (*In Parm.* IV 896, 22–33 [Cousin]) would only be valid, if every common element corresponded to a Form-in-matter. But there are exceptions, as Proclus himself admits in argument 2 (*In Remp.* I 258ff.). Our mind can form a concept of things of which no Form-in-matter or no *katholou logoi* exist. If we take *koinon* in the sense of *enhylon eidos*, argument 1 is sound. If we take it in its broader sense, as it is applied in argument 2, argument 1 is no longer valid. In general, one can state that for Proclus' theory of concept formation the concepts of things to which no *ousiôdês logos* or no psychic reason-principle corresponds, present a veritable test-case.

Nevertheless, both passages (i.e., as discussed in IIe and IIIf) share the doctrine that evil or ugly things can only be known by means of their contraries.⁹⁴ Against this background it becomes clear that the later-born

⁹² The relevant texts are collected in Dörrie/Baltes (1998), 132; see also the comprehensive commentary, *ibidem*, 336–350.

⁹³ Cf. Steel (2003), 108–112 at 110: “The fact that one can form an abstract universal starting from the multiplicity of similar instances, e.g. the ‘shuttle’ or the ‘bed’ or the ‘mud’, is not a sufficient argument to postulate the existence of a transcendent intelligible Idea corresponding to it.” Cf. also Proclus, *In Parm.* IV 884, 26–885, 32 (Cousin).

⁹⁴ I illustrated this in the case of the passage from the *Parmenides Commentary* with [T9]. For the second passage the reader can refer to *In Remp.* I 259, 20–21.

concept of evil, which is, according to *In Remp.* I 260, 22 solely derived from below (κάτωθεν or from sense perception) would not be sufficient to fully grasp the phenomenon "evil". If we want to know evil or form a sufficient concept of evil, we are still in need of the *ousiôdeis logoi* in the soul, as was shown in [T9]. This demonstrates, I think, that the truth is somewhere in between argument 1 and argument 2. A full understanding of evil or ugliness presupposes a later-born concept as well as a *logos* of its contrary.

III. Arguments from the First Prologue of *In Eucl.*

Apart from the passage in the fourth book of Proclus' *Commentary on Plato's Parmenides*, there are other passages where the Neoplatonist denies that universal concepts can be derived from sense perception. Most notable is his *Commentary on the First Book of Euclid's Elements*,⁹⁵ where Proclus deals with mathematical or geometrical concepts⁹⁶ and claims that these cannot be derived from sense perception. The soul must have received them from the intellect.⁹⁷

According to Proclus, there are two possible ways in which mathematical concepts could have been derived from sense perception. Either (1) they could be abstracted from the sensibles (κατὰ ἀφαίρεσιν) or (2) they could be gathered together (κατὰ συναθροισμόν) from the individuals into a common *logos* (or definition, as Morrow suggests).⁹⁸ It was argued by I. Mueller that Proclus here does not make a clear-cut distinction between these two modes of derivation.⁹⁹ It should, however, be noted that in the history of Ancient and Medieval philosophy these two modes of deriving a concept were clearly distinguished.¹⁰⁰

⁹⁵ *In Eucl.* 12, 2–15, 21, cf. also *In Eucl.* 48, 1–57, 8.

⁹⁶ For an interesting discussion about the difficulties involved in marking off mathematical/geometrical concepts from universal concepts cf. de Libera (1999), 35–42.

⁹⁷ Already Iamblichus rejected the theory of abstraction as the origin of mathematical concepts in the soul, cf. O'Meara (1989), 159, and Iamblichus, *De communi mathematica scientia* 34, 9–10 and 89, 2–6.

⁹⁸ (1) *In Eucl.* 12, 5–6; (2) *In Eucl.* 12, 6–7.

⁹⁹ "Nothing he says suggests that he considers the two proposed modes of derivation to be significantly different", Mueller (1987), 315.

¹⁰⁰ Cf. the comprehensive treatment of the matter by de Libera (1999).

IIIa. Proclus on “Abstraction” (ἀφαίρεσις) and “Collection” (ἄθροισμός, ἄθροισις)¹⁰¹

Another reason for distinguishing between abstraction and collection in Proclus is the fact that in his *Euclid Commentary* he gives two different refutations of these two different modes of deriving mathematical/geometrical universals.¹⁰² Without going into details here, I would suggest the following tentative remarks to clarify Proclus’ attitude towards these two modes of deriving a universal. As far as abstraction is concerned, it is a well known fact that Aristotle calls mathematical/geometrical objects *ta ex aphaireseôs legomena*.¹⁰³ How Aristotle exactly understood the process of abstraction is a much debated issue.¹⁰⁴ Proclus uses *aphairesis/aphairein* mostly in the context of negative theology and already in Plotinus we can observe such a tendency. At *In Eucl.* 12, 6, 15, 2, and 15, 16, however, he employs it in the sense of deriving a mathematical/geometrical concept. This usage is in accordance with Aristotle. Proclus criticizes such a mode of derivation, claiming that it would make soul inferior to matter.¹⁰⁵

The second mode of derivation (“collection”) is more interesting. It goes back, as was pointed out by Alain de Libera, to Plato’s *Phaedrus* 249b–c.¹⁰⁶ Because of the Platonic provenance “collection” is used by Proclus and Hermias¹⁰⁷ to describe a Neoplatonic account of concept formation, that is, the collection of a common element from a manifold of individuals in order to arrive at a unity (concept) in thought. Such a mode of derivation, however, can also be criticized by Proclus, as is plain

¹⁰¹ There are several other expressions to denote the process of “collection”; see Sorabji’s comprehensive contribution in this volume.

¹⁰² Cf. *In Eucl.* 14, 24–15, 15 (argument against abstraction) and *In Eucl.* 13, 27–14, 23 (argument against collection).

¹⁰³ Cf. e.g. *APo.* I 18, 81b3 and *De caelo* III 3, 299a15–16.

¹⁰⁴ Cf. the discussion in Cleary (1985) and Cleary (1995). According to Aristotle both the mathematician and the geometer investigate their objects without matter. Hence abstraction describes the separation in thought of something that is not separable from matter. Cf. Proclus, *In Eucl.* 14, 27–15, 3, who summarizes the position he is going to criticize.

¹⁰⁵ *In Eucl.* 15, 3–5.

¹⁰⁶ De Libera (1999), 232n.79. For a recent analysis of the Platonic passage the reader may refer to Helmig (2004). Note that the term ἄθροισμα was prominent in Stoicism. Chrysippus calls τέχνη an ἄθροισμα καταλήψεων (*SVF* 2, 23, 21–22 [= Sextus Empiricus, *Adv. Math.* VII 372]) and soul an ἄθροισμα ἐννοιῶν καὶ προλήψεων (*SVF* 2, 228, 23–24 [= Galen, *De Hipp. et Plat. plac.* V 3 (160)]).

¹⁰⁷ The passages are listed in Helmig (2004), 87n.16.

from the passage in the *Euclid Commentary*. But what is the explanation for this ambiguous attitude towards "collection"?

As I have argued elsewhere, Proclus' usage of "collection" does not imply a harmonization of Plato and Aristotle,¹⁰⁸ since for the Neoplatonist "collection" presupposes the reason-principles in the soul, something rather un-Aristotelian. Hence we can distinguish two kinds of "collection" in Proclus: Aristotelian "collection" and Platonic or Neoplatonic "collection" that presupposes the *logoi* of the soul.¹⁰⁹

Moreover, from several passages from the Commentators on Aristotle it becomes plain that Aristotle's account in the *Posterior Analytics* II 19, that is, the inductive process to arrive at a universal concept by means of several similar sense perceptions, was in fact understood as "collection".¹¹⁰ But also in Proclus there is evidence for such an understanding of *Posterior Analytics* II 19. If we take, for instance, Proclus' argument against the "collection" of mathematical/geometrical concepts from sense perception (*In Eucl.* 13, 27–14, 23), we see that he explicitly connects "collection" with the Aristotelian theory of demonstration. His argument, in fact, strongly resembles his argument from demonstration, summarized above under II d, and it is likewise directed against Aristotle's account in the *Posterior Analytics*.

Let me further illustrate this connection between *Posterior Analytics* II 19 and "collection" in Proclus by turning to an obscure passage in the second book of his *Commentary on Plato's Parmenides*,¹¹¹ where he gives a list of items that should not be identified with Platonic Forms. According to him, Forms are not identical with the Stoic *σπερματικοὶ λόγοι*. Secondly, Forms are not just concepts or thoughts in our soul (the conceptualist interpretation, which is for the first time formulated in Plato's *Parmenides*). The third alternative has caused some difficulties among scholars since it is not at all clear whom Proclus has in mind here. The passage says that Forms are not identical with "summaries of pervasive common characters in particulars" (*κεφαλαιώματα τοῦ ἐντρέχοντος κοινοῦ τοῖς πολλοῖς*),¹¹² as Morrow/Dillon translate the curious

¹⁰⁸ Helmig (2004), 93–94.

¹⁰⁹ This distinction between two kinds of "collection" is parallel to the distinction between two kinds of concepts of later origin, discussed above.

¹¹⁰ Cf. the contribution of Prof. Sorabji in this volume, who has conveniently put together the terminology the Commentators applied to describe the "assembling of a universal concept" in *APo.* II 19.

¹¹¹ *In Parm.* II 731, 18–35.

¹¹² *In Parm.* II 731, 19–20.

phrase. Nowhere in Proclus or in any other author is there a parallel for such a use of κεφαλαίωμα. Dillon himself suggested the Epicureans as the possible target of Proclus. But two passages in Themistius where he uses the verb *kephalaïousthai* make it plain that the rare usage of *kephalaiôma* must refer to the process of collecting concepts from the common elements in the particulars. In his *Paraphrase* of *APo. II 19* Themistius connects the verb with the process of *epagôgê*.¹¹³ Hence the parallel in Themistius most probably shows that Proclus' criticism of the "collection" of a universal concept from the common element/character in the sensible things is directed against the process of *epagôgê* described by Aristotle—and his Peripatetic commentators—in the last chapter of the *Posterior Analytics*.¹¹⁴ And it is very likely that Proclus systematically discussed and criticized this chapter in his lost *Commentary on the Posterior Analytics*.

IIIb. Every Triangle in Nature Falls Short of the Geometrical Triangle

Coming back to the first prologue of Proclus' *Commentary on Euclid*, from which our distinction between "abstraction" and "collection" took its start, it can be said that Proclus gives three replies (A, B, C) to the two possibilities of deriving mathematical/geometrical concepts [(1) abstraction; (2) collection], and the text makes it clear that reply B corresponds to (2), while reply C corresponds to (1).¹¹⁵ The first reply (A) is more general in nature and claims that mathematical cannot be

¹¹³ Themistius, *In DA* 64, 16–18, cf. also 3, 33. In this sense, the verb κεφαλαιοῦσθαι/ συγκεφαλαιοῦσθαι can already be found in Alexander, *In top.* 1, 18, cf. also *In metaph.* 5, 2 (συγκεφαλαίωσις). Cf. also the fine parallel in Plotinus VI 5 [23] 1, 10 (συγκεφαλαιοῦσθαι). I would like to thank Guy Guldentops (Leuven) for drawing my attention to the latter passage. Note, moreover, that Plotinus in VI 2 [43] 5, 12 calls soul κεφάλαιον τῶν λόγων.

¹¹⁴ Also Proclus' use of ἀθροίζειν and ἀθροισμός points in the same direction, cf. *In Eucl.* 14, 1 and *In Eucl.* 15, 17 with Themistius, *In De anima* 4, 2 and 56, 21. For this technical usage of συναθροίζειν cf. de Libera (1999), 229 ff. and 233 n.80. Moreover, the explicit criticisms Olympiodorus directs against passages from *APo. II 19* (see Olympiodorus, *In Phaed.* § 12 1, 18; § 4 7, 1 and 8, 1) are most likely derived from Proclus' lost *Commentary on the Phaedo*, since Westerink (1976), 18, has convincingly argued that Olympiodorus "used Proclus [sc. Proclus' lost *Commentary on Plato's Phaedo*, C.H.] as his principal and almost only source."

¹¹⁵ *First reply*: mathematical objects are not universals of later origin (*In Eucl.* 12, 9–13, 26); *second reply*: mathematical objects are not "collected" from the sensibles (*In Eucl.* 13, 27–14, 23); *third reply*: mathematical are not abstracted from the sensibles (*In Eucl.* 14, 24–15, 15).

later-born universals (ὕστερογενῆ).¹¹⁶ In what follows, I shall only give this first reply of Proclus, since the other two have already been discussed. As Morrow remarks in the notes of his translation, the frequent allusions to Aristotle in all three replies clearly show that they are directed against him.¹¹⁷

The first reply, then, runs as follows:¹¹⁸ It is not conceivable that geometrical objects like a circle or a triangle are derived from sense perception since among the sensibles such ideal objects do not exist. No triangle in nature corresponds to the ideal triangle that geometers deal with. Sensible geometrical objects are never as exact as is required for geometrical operations. Therefore, the exactness or precision (ἀκρίβεια) of geometricals cannot stem from the sensibles. It must stem from the reason-principles in soul, which soul, in turn, receives from intellect.¹¹⁹ Such a classical argument against empiricism is already familiar from Plato's *Phaedo*. There, it is said that equality can never be abstracted from sensible things, because in our world the pure equal (τὸ ἴσον) does not exist. It is always mixed with the unequal (τὸ ἄνισον). And the same holds also true for all other Forms (*Phaed.* 75 c–d).

IV. CONCLUSION

In this article, I have tried to systematically collect and comment on passages that illustrate Proclus' criticism of a theory that claims that universal concepts can be derived from sense perception. In conclusion, I shall briefly summarise Proclus' arguments. As we have seen, Proclus explicitly refers to Aristotle's interpretation of the universal as being either in the things or a concept of later origin (ὕστερογενές), that is, a concept derived from sense perception. The process of deriving a universal concept from sense-data is described in great detail in the last chapter of the second book of the *Posterior Analytics*. As is shown in (III), Proclus identifies this mode of deriving a concept with "collection"

¹¹⁶ Proclus' summary of the discussion (*In Eucl.* 15, 16–19) enumerates the three replies in reverse order, starting with abstraction and ending with the later-born universal.

¹¹⁷ Cf. Morrow (1970), 12n.23 and 13n.26, and O'Meara (1989), 159, who also states that Proclus "assembles arguments against Aristotle".

¹¹⁸ This and the other arguments are discussed by O'Meara (1989), 159.

¹¹⁹ As Prof. Sorabji points out in this volume, p. 12–13, this argument goes back to Syrianus, *In met.* 91, 24–29. The passage is briefly discussed by Mueller (1990), 472.

and he stresses that it cannot provide the appropriate starting points for demonstration (IIId).

In his criticism, the Neoplatonist makes much out of the fact that the abstracted universal (ὑστερογενές) is posterior to the objects of sense perception. In the process of abstraction it becomes fainter and less clear compared to the sensibles (I). Proclus' main arguments have an ontological basis (II). Since the whole of sensible reality was produced by nature through *logoi*, which nature, in turn, received from the world soul, we can only have reliable knowledge of the world around us by means of these *logoi* that every soul possesses. Through them we can judge and correct sense perception (IIb) and only through them it is possible to comprehend the reality *according to its causes*. Therefore, true concepts of later origin (*hysterogenes* in a positive or Neoplatonic sense, see above 3.1) must be images of these *logoi* (IIa and IIc). Finally, Proclus explains that every triangle in nature falls short of the precise or ideal triangle the geometer deals with (III), and only by means of the psychic *logoi* we can supply (IIb) what the objects of sense perception lack in order to arrive at a perfect concept of triangle.

Although nowhere in his extant works Proclus explicitly refers to the last chapter of Aristotle's *Posterior Analytics*, based on his criticism of the *hysterogenes* and the other arguments discussed above, we can, I think, infer that in his lost commentary on the *Posterior Analytics* Proclus must have criticised Aristotle by means of very similar arguments.

EUSTRATIUS' COMMENTS ON *POSTERIOR ANALYTICS* II 19

KATERINA IERODIAKONOU

1. INTRODUCTION

Very few commentaries on the *Posterior Analytics* have come down to us from antiquity: some fragments of Alexander of Aphrodisias' commentary, Themistius' short paraphrasis and Philoponus' 440 pages long commentary.¹ It, therefore, can be particularly illuminating and intriguing to study the comments on this Aristotelian treatise which have survived from the Byzantine period. However, even from Byzantine times we do not have many substantial commentaries on the *Posterior Analytics*: there are commentaries just on the second book by Eustratius of Nicaea and Theodore Prodromos in the twelfth century, there are scattered comments by Leo Magentenos in the thirteenth century, and finally we have a paraphrasis in Joseph Rhacendytes' encyclopaedia as well as some comments on the first book by John Pediasimos in the fourteenth century.² Of these texts Eustratius' commentary was edited in 1907 by Michael Hayduck as part of the *Commentaria in Aristotelem Graeca* series, while Pediasimos' comments were edited separately in 1926 by Victor de Falco.³ Michel Cacouros has undertaken an edition of Prodromos' commentary, but there has been no interest in the works of Magentenos and Rhacendytes.

The above list of Byzantine commentaries on the *Posterior Analytics* in some sense is quite surprising: Byzantine philosophers like Michael Psellos and John Italos, who were quite famous in the eleventh century for their profound knowledge of Aristotelian logic, seem to have written nothing on this logical treatise. In addition, the widely read introductions to logic of the eleventh and thirteenth century, namely the elementary handbook known as the *Anonymus Heiberg* and Nicephoros Blemmydes'

¹ Moraux (1979); Wallies (1900) and (1909).

² Wartelle (1963) and Benakis (1988), 3–12.

³ Hayduck (1907) and De Falco (1926).

Epitome, devote no section to the *Posterior Analytics*.⁴ But before one attempts to draw conclusions from this about the Byzantine interest in this logical treatise or about the educational program in Byzantium, it is important to carefully investigate all the anonymous commentaries on the *Posterior Analytics* which are to be found in a considerable number of manuscripts; such an anonymous commentary, for instance, has been edited by Maximilian Wallies in the CAG series in conjunction with Philoponus' commentary.⁵ It also is important to make sure that there are no other commentaries by eminent or less well known Byzantine authors hidden in manuscripts in libraries around the world; for instance, André Wartelle's inventory of Aristotelian manuscripts (no. 992) cautiously attributes to Psellos a paraphrase of the *Posterior Analytics*, though one needs to check the sixteenth century manuscript which contains it, namely the Ambrosianus 827 (A 229 inf.), since Wartelle's catalogue is notoriously unreliable.⁶

In this paper I want to focus on Eustratius' commentary, not only because there is a reasonable edition of it, which thus makes it easily accessible, but because it is the first known commentary in the Byzantine tradition of commentaries on the *Posterior Analytics* and seems to have been particularly influential, for instance, on Prodrornos' subsequent commentary.⁷ Most importantly, I want to focus on Eustratius' commentary, because I think that its close study shows that this Byzantine commentator does not simply copy his ancient predecessors, at least not those whose commentaries we still have. There is no doubt, of course, that Eustratius makes use of Alexander's comments as well as of Themistius' paraphrase, to both of whom he explicitly refers.⁸ At the same time, though, we do find among his comments a number of novel ideas, of which some could have been borrowed from lost ancient commentaries, but others probably reflect a Byzantine approach to the *Posterior Analytics*; some perhaps are due to Eustratius himself.

Unfortunately, we have little information about Eustratius himself. He was the Metropolitan of Nicaea at the beginning of the twelfth century and was asked by the emperor Alexios I to participate in various theological debates with the Latin Church, until he was finally condemned for

⁴ Heiberg (1929) and Wegelin (1865), 675–1004.

⁵ Wallies (1900) and (1909).

⁶ Wartelle (1963).

⁷ Cacouros (1989), 313–338.

⁸ Eustratius, *In APo.* 1.5; 2.28; 19.1; 44.5; 61.21; 63.31; 69.18; 107.22; 113.21; 123.24–25; 125.17; 126.19 and 11.5–6.

heresy in 1117. The reasons for his condemnation are a rather complicated matter involving both theological and political issues which cannot be addressed here. What is relevant for our purposes, though, is that most probably he also was a member of Anna Comnena's intellectual circle which had undertaken the task of producing commentaries on Aristotle's works.⁹ Anna Comnena in the *Alexiad* (14.8), the history she wrote of the events during the reign of her father Alexios I, presents Eustratius as a scholar extremely erudite both in religious and in secular literature, as well as a master of dialectic. It is interesting to note that he became famous for his strong conviction for the propriety of using Aristotle's syllogistic in theology; he even stated that Christ himself had argued with the help of Aristotelian syllogisms.¹⁰ What we have of his work as a commentator, apart from his work on the second book of the *Posterior Analytics*, are his comments on the first and sixth book of the *Nicomachean Ethics*.¹¹ It may be that in the case of the *Nicomachean Ethics* the reason why he chose to comment on these particular books was that at the time there were available in Byzantium commentaries on the other books by anonymous authors and by Michael of Ephesus, another member of the Comnena circle.¹² It is not clear, however, why Eustratius chose to comment only on the second book of the *Posterior Analytics*, especially since it seems that the whole of Alexander's commentary was still accessible. Was there perhaps at the time already a commentary on the first book written by another Byzantine scholar? A closer inspection of the available manuscripts might throw some light on this question.

But this is not my objective here. I rather want to discuss the content of Eustratius' commentary, and in particular certain passages from his commentary which seem to contain novel and philosophically interesting interpretations of Aristotle's text. In particular, I want to discuss the comments on the last chapter of the *Posterior Analytics*, chapter II 19, a chapter which has been at the centre of scholarly debate for many centuries down to the present day. It also is worth noting that Eustratius' comments on II 19 (255.1–270.14) are not just more detailed than Themistius' paraphrase (62.21–66.6), but even more detailed than Philoponus' comments (432.25–439.12). The specific topics which I want to address in connection with Eustratius' comments on this chapter are the following:

⁹ Browning (1962), 1–12.

¹⁰ Joannou (1952), 24–34.

¹¹ Heylbut (1892).

¹² Heylbut (1892).

- I. Eustratius' account of the knowledge of first principles.
- II. The distinction, according to Eustratius, between art and science.

My aim is to get clearer about how Aristotle's *Posterior Analytics* II 19 was read and interpreted in the twelfth century by a scholar who had access to ancient commentaries on this text which are now lost, but who also was deeply immersed in the Christian culture of his time.

First, though, a preliminary point of methodology: Eustratius devotes fifteen printed pages of his commentary on the *Posterior Analytics* on this particular chapter, but after presenting us with an overall interpretation in the first five pages, he seems more or less to repeat the same remarks in what follows. In fact, the repetitions are so many that one starts wondering whether these five pages might be a section from another commentary which the editor mistook for Eustratius' comments. Besides, apart from the repetitions, the terminology slightly differs, and there also is one particular instant in which Eustratius, if he is indeed the author of both parts, seems to be inconsistent. I will discuss this particular text in a moment. For the time being, it should be pointed out that it is not unusual in the Aristotelian commentaries to find at the beginning of each section a short overview of what will be discussed next, and then to comment on the text line by line. On the other hand, given the way commentaries in the manuscript tradition often were transmitted, namely as glosses taken from different commentators in the margin of the manuscript of the Aristotelian text in question, it is also not unprecedented for editors of Aristotelian commentaries to get confused and to take what is in fact part of a different commentary to belong to the commentary they are editing. If one wants to be absolutely certain that Hayduck is right to include these first five pages in Eustratius' commentary, one would need to examine the manuscripts which he used, namely the twelfth century Marcianus gr. 257 and the sixteenth century Escorialensis Φ-I-14. Hayduck in the brief preface of his edition says that the two manuscripts differ in many places, but he makes no specific remark about our section of the text. Hence, one would need to check again these manuscripts as well as another manuscript of the fourteenth, or maybe fifteenth, century from Udine, which, according to Wartelle's catalogue, also contains Eustratius' commentary (no. 2096). Until this is done, however, we should take Eustratius' text as it is in Hayduck's edition.

2. THE KNOWLEDGE OF FIRST PRINCIPLES

Right at the beginning of his commentary on *APo.* II 19 (255.22–33) Eustratius claims that, since the subject of the *Posterior Analytics* is demonstration, and every demonstration ultimately depends on first principles, Aristotle's last chapter of this logical treatise is rightly devoted to the issue of how we can acquire knowledge of first principles. Eustratius, then, identifies and discusses in detail the two related questions concerning the acquisition of the knowledge of first principles which are raised in Aristotle's text (99b17–19):

- (i) How do we come to know first principles? Do we have innate knowledge of them, or do we acquire them on the basis of previously acquired knowledge?
- (ii) Which is the cognitive state or disposition (*hexis*) in virtue of which we come to know first principles?

To answer the first question, Eustratius (255.33 ff.) starts by closely following Aristotle's reasoning. It is not possible to have innate knowledge of first principles, since this is the most accurate and the highest form of knowledge one can have, and it is not possible to have this kind of knowledge without being aware of it. But we obviously are not aware that we already have this knowledge; otherwise we would not try to acquire it. Yet it also is not possible to acquire knowledge of first principles through demonstration, because this would mean that the principles one comes to know depend on other prior principles, and thus cannot be first principles, and we would fall into an infinite regress, having to demonstrate these further principles. Eustratius hence says that, according to Aristotle, we need to assume that human beings are endowed by nature with a cognitive power or capacity (*dunamis*) which enables them to acquire knowledge of first principles. They are not born with knowledge of first principles, but they are born with the cognitive capacity to acquire such knowledge. For human beings are able to perceive and, unlike plants and certain animals, are able to retain in their soul what they perceive; in this way they have memory and, on the basis of this, experience. Most importantly, human beings, unlike all other animals, are able to grasp with their intellect (*nous*) the universal (*to katholou*) in what they know from experience, on the basis of a single or of repeated occurrences of particular instances by induction (*epagôgê*).

There is nothing surprising up to this point in Eustratius' presentation of Aristotle's views. Eustratius, of course, uses terms which are not

to be found in Aristotle's text; for instance, '*tupoi*' is used for the imprints or impressions which sense perception produces in the soul,¹³ '*koinai ennoiai*' is used interchangeably with the standard term '*ta katholou*' in the short overview of the first five pages,¹⁴ and '*prokopê*' is used to express the soul's progress in its understanding of the universals.¹⁵ These terms are recognizably Stoic in their origin, but the Aristotelian commentators before Eustratius had also used them, even if not in this particular context.¹⁶ After this initial presentation of Aristotle's theory, however, Eustratius (257.33 ff.) digresses from the text of the *Posterior Analytics* and adds his own assessment of how we come to acquire knowledge of first principles. First, though, he summarizes Aristotle's position and compares it with Plato's. He claims that both Plato and Aristotle should be understood as suggesting that we do not have knowledge of first principles right from the beginning of our lives (257.27–32).¹⁷ According to Plato, says Eustratius, the soul before birth must have had knowledge of first principles, but forgot them when it became embodied; sense perception helps us to recollect some of this forgotten knowledge (*anamnêsis*). In the view of Aristotle, too, according to Eustratius, the soul does not have actual knowledge of first principles when we are born, but only knows them potentially (*dunamei*); it is again with the help of sense perception that our inborn intellect comes to have this knowledge in actuality (*energeia*).

Eustratius' presentation of the Platonic account of how we come to know first principles follows closely what Plato himself says in the *Phaedo* (72e3 ff.) about acquiring knowledge in general: our immortal soul possessed knowledge before birth, but we lost this knowledge on being born; later on, prompted by our senses, and with the help of reflection, we regain the knowledge that we possessed at some former time. On the other hand, Eustratius interprets Aristotle's view in a manner which seems foreign to what Aristotle himself says, at least in the last chapter of

¹³ Eustratius, *In APo.* 256.24; 34; 257.26; 263.5; 11; 20; 265.17; 267.3.

¹⁴ Eustratius, *In APo.* 257.19; 38; 258.9–10.

¹⁵ Eustratius, *In APo.* 257.12; 25; 262.30; 263.27; 265.2; 265.20; 266.4.

¹⁶ *tupoi*: e.g. Themistius, *In APo.* 63.10; 12; 31; 34; *koinai ennoiai*: e.g. Themistius, *In APo.* 7.2; Philoponus, *In APo.* 254.31; 266.22; 315.28; *prokopê*: e.g. Philoponus, *In APo.* 438.17.

¹⁷ καὶ τὸ πρῶτον Πλάτων μὲν ἂν εἴποι ἀνάμνησιν, λήθην μὲν πασχούσης τῆς ψυχῆς, ὡς ἐκεῖνός φησι, διὰ τὴν εἰς τὴν γένεσιν κάθοδον, κατὰ μικρὸν δὲ προϊούσης εἰς τὴν τοῦ ἐπιλησθέντος ἀνάληψιν διὰ τῆς κατὰ αἴσθησιν γνώσεως, Ἀριστοτέλης δὲ ἐκ τοῦ δυνάμει εἰς τὸ ἐνεργεῖα μεταβολήν, δυνάμει λέγων ταῖς ἀνθρωπίναις ψυχαῖς ἐνεῖναι τὸν νοῦν ἐξ ἀρχῆς, καὶ διὰ τῶν αἰσθημάτων προέρχεσθαι εἰς ἐνέργειαν.

the *Posterior Analytics*; for the distinction between knowing first principles potentially and knowing them in actuality is nowhere drawn in this text. Aristotle talks of the capacity which we possess as human beings to have memories and to build up the necessary experience which allows us to grasp the universal, but he does not claim, at least not in the *Posterior Analytics*, that we are born with potential knowledge of first principles which then becomes actual knowledge by means of the information we gain through our sense perceptions. That is to say, although Aristotle in *APo.* II 19 seems to explain how we come to acquire with time the disposition to know first principles, Eustratius claims that on Aristotle's view this disposition, i.e. our intellect, is innate in the human soul right from the beginning (*eneinai ton noun ex archês*: 257.31–32).

Does Eustratius misinterpret Aristotle? Or does he just formulate Aristotle's doctrine in a way different from what we find in the *Posterior Analytics*, but still in a perfectly Aristotelian way? The Aristotelian text which can be brought to Eustratius' defence is *De Anima* III 4 (429b29–430a2). Aristotle here famously draws the distinction between the potential intellect (*dunamei*) and the intellect in actuality (*entelecheia*). He claims that the intellect in a way potentially is the objects of thought, though it actually is nothing before it thinks; and he also uses a metaphor to explain what he means: the intellect potentially is the objects of thought in the same sense as there potentially is something written on a wax tablet on which actually nothing is written. On the basis of this text, therefore, it might seem plausible to Eustratius that in the last chapter of the *Posterior Analytics* Aristotle claims that the intellect is innate in the soul of human beings in the sense that they potentially have knowledge of first principles, i.e. that human beings potentially have intellect or reason even before they actually start thinking. To put it differently, according to Eustratius' interpretation, human beings are born rational in the sense that they potentially have knowledge of first principles, and it is only after they acquire experience of the world through their senses that they come to possess such knowledge in actuality.

But is Eustratius right in using the *De Anima* passage in order to interpret what Aristotle says in *APo.* II 19? In the *Posterior Analytics* (99b25) Aristotle asks the question whether we are born with the disposition to know first principles or whether we acquire this disposition with time. There is no indication, however, that the distinction in the *De Anima* between the potential and the actual intellect is meant to provide a generic account of the development of reason. Aristotle in the *De Anima* talks of the progression from potential to actual reason in the sense that

it is only with the acquisition of the forms that our intellect is able to actually think. But this intellect is already the intellect which has been developed on the basis of our sense perceptions, our memories and our experience. Hence, Aristotle does not seem to address the same question in the two texts, and Eustratius' attempt to bring them together proves, I think, misleading.

Furthermore, however one understands the relation between the two Aristotelian texts, Eustratius' interpretation does not seem to correspond to what Aristotle says in the *Posterior Analytics*. According to Aristotle, human beings do not possess the disposition to know first principles when they are born, but they acquire reason only with time (*ginesthai logon*: 100a2) in virtue of their capacity to have sense perceptions, memories and experience. Of course the interpretation of this text depends on how we are to understand in general the notion of the intellect or reason in Aristotle; that is to say, it depends on what it means for Aristotle that human beings are rational.¹⁸ For if we are to understand reason as the disposition to know first principles and to grasp the universal, then human beings are certainly not born with such a disposition but acquire it with time; what we are born with is simply the disposition to perceive, to retain our memories, and to acquire experience, and this in the course of a natural development can give rise to universal concepts and thus to the acquisition of reason. Therefore, even if we talk of potential reason or intellect, all this can mean is that we have the disposition to perceive through our senses and to have memories and to, on the basis of this, then form concepts by means of which we grasp universals and first principles, rather than what Eustratius presents as some kind of potential knowledge of first principles.

But I think that there is an important motivation why Eustratius reads II 19 the way he does in the light of the *De Anima* passage. For in this way he can present Aristotle's position as parallel to Plato's: they both agree, according to Eustratius, that human beings are not born with full knowledge of first principles; in the case of Plato such knowledge is forgotten as soon as we are born, while in the case of Aristotle when we are born we only possess potential and not actual knowledge of first principles (cf. also, 261.6–10). There are two reasons which could explain why Eustratius wants to portray the views of Plato and Aristotle in this way: first, he shares the Neoplatonists' concern to see the views

¹⁸ Frede (1996), 157–173.

of these two ancient philosophers as being close to each other, if not in agreement, a concern which can be found in the writings of many Byzantine thinkers in connection with many philosophical issues; and second, he is interested in grouping Plato and Aristotle together, so that he may present his own account of how we come to know first principles as constituting an alternative to theirs. What immediately follows the summary of Plato's and Aristotle's position strongly suggests that the motivation behind Eustratius' reading of Aristotle's text has rather to do with the view which he himself wants to defend on the subject of the knowledge of first principles.

Eustratius (257.33–258.27)¹⁹ says that he should not spend more time discussing other philosophers' views; instead, he wants to add something relevant to this subject, a view that he himself seems to espouse. As his starting point Eustratius takes the following general claim, which obviously has its origin in Neoplatonism: since in the hierarchy of beings the soul comes right after the intellect, the soul participates (*metexein*) more than anything else in what the intellect grasps (*epibolai tou nou*); thus the common and self-evident (*autopistoi*) notions of the soul are nothing but resonances (*apêchēmata*) of what the intellect grasps. However, Eustratius continues, these common and evident notions which the soul has right from the beginning, i.e. the first principles, are often obscured and dominated by the impulses (*hormai*) of the vegetative and vital powers of the body. It is only when our soul is guided either by our sense perceptions or by appropriate teaching that the common and evident notions come forth (*proballein*), so that we, as it were, wake up and can immediately assent (*sunkatatithesthai*) to the first principles.

¹⁹ 257.33–258.9: Ἄλλ' ἄλλοτρίαις μὲν δόξαις διαιτᾶν καὶ ὥς ἔχουσιν ἀληθείας ἢ ψεύδους ἐξετάζειν ἐν τῷ παρόντι περιττόν· οὐκ ἄχαρι δ' ἴσως λόγον προσθεῖναι τινα τοῦ πράγματος ἐφαπτόμενον. ἐν τῇ τάξει τῶν εἰδῶν τὰ προσεχῶς μετὰ τι μετέχει τρανότερον τοῦ προσεχῶς πρὸ αὐτῶν. ἐπεὶ οὖν ἡ ψυχὴ προσεχῶς μετὰ νοῦν, μετέχει τοῦ νοῦ μᾶλλον ἢ περὶ τὰ πόρρω τοῦ νοῦ, καὶ τούτου ἐν αὐτῇ ἀπηχήματα αἱ κοινὰ καὶ αὐτόπιστοι ἔννοιαι, δι' ὧν περ φέρει τινα πρὸς τὰς ἀμέσους τοῦ νοῦ ἐπιβολὰς ἀπομίμῃσιν, αἱ δὲ ἐξ ἀρχῆς μὲν αὐτῇ ὥς ἐμπυρεύματα ἐν αἰθάλῃ ἀποκεκρύφονται τῇ ἐπικρατείᾳ τῶν χειρόνων δυνάμεων συγγεόμεναι, λέγω δὲ τῆς φυτικῆς τε καὶ ζωτικῆς, διὰ τὸ φθανούσας ταύτας ἐνεργεῖν ἐν τῷ σώματι γενεσιουργούς τε οὖσας τῷ τε σώματι προσεχῶς χορηγούσας τὴν σύστασιν, καὶ τοῦτο ἐπιτήδειον πρὸς τὰς δι' αὐτοῦ ἐνεργείας παρασκευαζούσας τῇ κρείττονι. ὧν ἐνεργουσῶν σὺν σφοδρότητι ἀπροσεκτεῖν ἑαυτῇ συμβαίνει τὴν λογικὴν ὑπὸ τῆς ἐκείνων κατασφυρομένην ὁρμῆς καὶ ἀπειρώς ἐτι ἔχουσιν τῆς ἐνταῦθα θεωρίας καὶ πράξεως, καὶ ποδηγίας δεομένην, ἵν' ἑαυτῇ τὴν ἐπιστήμην καὶ τὰς ἐγκειμένας ἐννοίας προβάληται.

Some of the terms used here have their origin in Hellenistic philosophy; for instance, ‘*epibolai tou nou*’, ‘*sunkatatithesthai*’ and ‘*hormai*’. But all of these as well as some of the other terms, like ‘*autopistoi*’ and ‘*apêchêmata*’, were also used by the Neoplatonists in similar contexts.²⁰ Is it the case, then, that the view which Eustratius presents here is a view he inherited from the Neoplatonists? There is no doubt that Eustratius’ starting point is of Neoplatonic origin. It seems, however, that this is where the Neoplatonic influence ends, since Eustratius’ view does not correspond to what the Neoplatonists standardly claim about knowledge of the Ideas. For Eustratius’ claim that our soul does have knowledge of first principles right from the beginning, but that it is the impulses of our body which obscure our understanding of the universal, differs both from what Plato and the Platonists hold as well as from what Aristotle says. That is to say, Eustratius does not think that the human soul regains pieces of knowledge, which we possessed at some former time, nor does he think that it has only potential knowledge which then becomes actual. On the contrary, he seems to believe that the human soul has full knowledge of the principles, the common, self-evident concepts, already when we are born, but that this knowledge is obscured by our bodily impulses. And this is a view, I think, which is of Christian origin. For the soul, according to the Christians, when created by God, is created perfect, that is with all the knowledge it needs; if human beings lose sight of the knowledge and understanding which their soul possesses, it is because they are susceptible to the impulses generated by their body.

In this connection it is interesting to note an argument which Eustratius attributes to Aristotle, though we do not find any trace of it in the *Posterior Analytics*. Eustratius (263.27–32)²¹ claims that, according to Aristotle, we do not have innate knowledge of first principles, and he adds in a parenthesis the reason, namely that we would otherwise be born perfect (*an êmen gennômenoi*). This same argument can also be found in Themistius’ paraphrasis of the *Posterior Analytics*, though Themistius

²⁰ *epibolai tou nou*: e.g. Plotinus, *Enn.* 2.4.10.3; 6.2.4.23; 6.3.18.12; Philoponus, *In APo.* 4.7; *autopistos*: e.g. Proclus, *in Princ. Eucl. elem.* 76.13; 179.14; 194.6; 255.17; Philoponus, *In APo.* 167.27; 168.13; 184.23–24; 226.14–15; *apêchêmata*: e.g. Proclus, *in Alcib.* 135.10; *in Parm.* 947.31.

²¹ τὸ δὲ καθόλου ἐστὶν ἀρχὴ τῆς τέχνης καὶ τῆς ἐπιστήμης, ὥς εἶναι δῆλον ὅτι οὐτε ἔναισιν ἡμῖν ἐξ ἀρχῆς αἱ τῶν ἀρχῶν γνώσεις (τέλειοι γὰρ ἂν ἡμεν γεννώμενοι) οὐτε ἀπὸ γνωστικωτέρας τινὸς ἕξεως ἐγγίνονται, ὥς εἶναι ἀνάγκη προειδέναι τὸ πρὸ αὐτῶν, ἀλλ’ ἐγγίνονται ἡμῖν κατὰ μικρὸν ἀθροιζόμεναι ἀπὸ μνήμης τε καὶ αἰσθήσεως.

(63.23–29)²² says, again in a parenthesis, but in slightly different phrasing, that we do not have innate knowledge of first principles because in that case we would be perfect (*an egenometha*). I think that the meaning in both cases is the same. Both Themistius and Eustratius believe that this argument is implicitly in Aristotle's text; that is to say, they both believe that Aristotle would not agree with the view that human beings are perfect right from the start. The difference in the use of verbs '*gignesthai*' and '*gennasthai*' thus does not seem important. However, it is tempting to ask why Eustratius would change the verb. My suggestion is, though it is obviously a tentative one, that Eustratius attributes to Aristotle this argument phrased in this particular way, because it is exactly the Aristotelian view that human beings are not born perfect which he opposes.

To conclude the topic of the knowledge of first principles, in the first five pages of his commentary on *Posterior Analytics* II 19 Eustratius seems to clearly distinguish his view from those of Plato and Aristotle in part in order to be in line with Christian dogma. What is really puzzling, though, is that later on in his more detailed commentary (264.30–265.10),²³ Eustratius seems to attribute to Aristotle a position which is a compilation both of what he previously presented as Aristotle's account and of his own account. That is to say, Eustratius claims there that, according to Aristotle, it is because of the non-rational impulses (*hormai*) that our soul fails to possess actual knowledge. This is neither what Aristotle says in the *Posterior Analytics* nor what Eustratius earlier on presents him

²² καὶ ἔστι τὸ καθόλου τὸ ὁμοιον καὶ ταῦτὸν ἐν τοῖς καθ' ἕκαστον καὶ τὸ ἐν τοῖς πολλοῖς, καὶ τοῦτο τέχνης ἀρχὴ καὶ ἐπιστήμης, τέχνης μὲν, εἰ περὶ τῶν ὑπ' αὐτῆς γινομένων, ἐπιστήμης δέ, εἰ περὶ τῶν ὑπὸ φύσεως. οὔτε οὖν ἐξ ἀρχῆς ἐνυπάρχουσιν αἱ ἀρχαί (τέλειοι γὰρ ἂν ἐγενόμεθα), οὔτε ἀπ' ἄλλης ἕξεως ἐγγίνονται γνωστικωτέρας ὥστ' ἐξ ἀνάγκης τι προσιδέναι, ἀλλ' ἀπὸ αἰσθήσεως καὶ μνήμης διεγείρονται καὶ ἀθροίζονται.

²³ Ἐκ τῶν εἰρημένων, φησί, δῆλον γέγονεν, ὅτι οὐδετέρων τῶν ὑποθέσεων ἀναγκαῖον ὁμολογεῖν, αἷς τὰ ἄτοπα εἶπετο. οὔτε γὰρ εἰσιν ἐν ἡμῖν ἕξεις ἀρχῆθεν τῶν καθόλου καὶ τῶν ἀρχῶν ἀφωρισμένα, ἤγουν συνεστηκῆται καὶ ἐνεργεῖα ὑπάρχουσιν, οὔτε μὴ οὔσαι γίνονται ἀπὸ τινων ἐτέρων ἕξεων κρειτόνων τε καὶ γνωστικωτέρων, ὥσπερ αἱ ἀποδείξεις, ἀλλ' ἀπὸ τῆς χείρονος καὶ συμφύτου τοῖς ζῴοις αἰσθήσεως ταῖς κατὰ μικρὸν προσθήκαις καὶ ταῖς κατὰ μέρος γνώσεσιν εἰς τὴν τοῦ ὁμοίου καὶ πᾶσιν τοῖς καθ' ἕκαστα ἐνόντος ταῦτο γινώσκοντι τῆς προκοπῆς. τίθησι δὲ καὶ παραδείγματα· οἷον γὰρ, φησὶν, ἐν μάχῃ συμβαίνει, ὁπότεν τροπὴ γένηται, εἴτα εἰς τῶν φευγόντων στή καὶ ἐπ' αὐτῷ δευτέρος καὶ τρίτος ἄλλος, ἕως πολλῶν στάντων πάλιν ἐπ' ἀρχὴν ἦλθεν ἡ μάχη. τοιοῦτον γὰρ καὶ ἐπὶ τοῦ καθόλου γίνεται· κατακρατεῖται γὰρ ὑπὸ τῆς ὁμῆς ἡ ψυχὴ τῶν ἀλόγων δυνάμεων καὶ τοὺς ἐν αὐτῇ λόγους ἀνεργήτους φέρει εἰδ' ἐνὸς ληφθέντος αὐτῇ ἐκ τῆς αἰσθήσεως τῶν καθ' ἕκαστα, καὶ ἐπ' αὐτῷ ἄλλου καὶ τρίτου ἐτέρου καὶ τετάρτου αὐτῆς, οὕτω κατὰ μικρὸν ἢ τοῦ καθόλου στάσις καὶ στερεώσις ἐν αὐτῇ γίνεται.

as having said. Should we on the basis of this passage doubt Eustratius' authorship of the first five pages of this commentary on II 19? Or should we simply regard it as a careless remark on Eustratius' part?

3. THE DISTINCTION BETWEEN ART AND SCIENCE

The second question which Aristotle raises in the last chapter of the *Posterior Analytics*, namely the question concerning the cognitive state or disposition (*hexis*) in virtue of which we come to know the first principles, introduces us to our next topic, the distinction between art and science. Eustratius (259.15–37)²⁴ claims that, according to Aristotle, human beings have certain cognitive dispositions which are always reliable and others which are sometimes true and sometimes go wrong. Practical reason (*logismos* or *praktikos nous*) and belief (*doxa*) are sometimes right and sometimes go wrong, whereas science or scientific knowledge (*epistêmê*) and the intellect (*nous*) are always right. Hence, it is science and the intellect which are the cognitive dispositions relevant to the case of first principles, since first principles are always true. Now, of these two cognitive dispositions science cannot be the one in virtue of which we know first principles, because scientific knowledge always requires an explanation, i.e. a demonstration, and to require a demonstration of first principles is to invite an infinite regress. Therefore, Eustratius concludes, it is in virtue of the intellect, according to Aristotle, that we come to know first principles.

It is clear from the above discussion in Eustratius' commentary that science has the following two characteristics: first, it is a cognitive state or disposition which is always reliable, and second, it always requires a demonstration. In fact, these two characteristics also constitute the criteria on the basis of which Eustratius distinguishes science (*epistêmê*)

²⁴ 259.15–29: ἀλλ' ἐπεὶ περὶ ἡ διάνοιά ἐστι καθ' ἣν ὁ ἄνθρωπος ἢ ἄνθρωπος ἐνεργεῖν πέφυκεν, ἴδωμεν τὰς περὶ αὐτὴν ἕξεις. τούτων οὖν αἱ μὲν αἰ ἀληθεῖς εἰσιν, αἱ δὲ ποτὲ καὶ ψευδεῖς. ποτὲ μὲν οὖν τὸ ψευδὸς εἰσι δεχόμεναι δόξα καὶ λογισμός, ἀπερ' αὐφω μὲν περὶ τῶν ἄλλοτε ἄλλως ἔχόντων, ἀλλ' ἡ μὲν εἰς θεωρίαν μόνην πολλάκις κατανατᾷ προᾷξιν μὴ ἔχουσαν, ὁ δὲ λογισμός εἰς προᾷξιν αἰ ἀποτείνεται· διὸ καὶ πρακτικὸς νοῦς ὀνομάζεται. ἀληθεῖς δὲ αἰ ἐπιστήμη ἐστὶ καὶ νοῦς. ἐπεὶ οὖν κρείττων ἡ γνώσις τῶν ἀρχῶν, εἴη ἂν καὶ κρείττονος ἕξεως ἡ κατὰ δόξαν καὶ λογισμόν, ὥστ' ἡ ἐπιστήμη ἢ νοῦς. ἀλλὰ πᾶσα ἐπιστήμη μετὰ λόγου· ὥστ' εἰ ἐπιστήμη γνώσις τῶν ἀρχῶν, εἴη ἂν ἡ γνώσις τῶν ἀρχῶν μετὰ λόγου. ἀλλὰ πᾶς λόγος ἐπιστημονικὸς ἐξ ἀρχῆς· ἔσσονται δὲ ἀρχαὶ τῶν ἀρχῶν καὶ οὕτω προοῖοι ἂν ὁ λόγος ἐπ' ἀπειρον.λείπεται ἄρα κρείττονος ἢ κατ' ἐπιστήμην ἕξεως εἶναι τὴν γνώσιν τῶν ἀρχῶν. κρείττων δὲ ἐπιστήμης γνωστικὴ ἕξις οὐκ ἔστιν ἄλλη ἢ νοῦς· ἄρα γνωστικὸς τῶν ἀρχῶν.

from art (*technê*), a distinction drawn and closely investigated by all the commentators of the *Posterior Analytics*, though no such treatment is to be found in this Aristotelian treatise. The commentators distinguish between science and art both in the context of the distinction between the different cognitive dispositions and in connection with Aristotle's statement in *Posterior Analytics* II 19 (100a8–9) that it is a universal which is a principle of art or a principle of science, of art if it concerns something which comes to be and of science if it concerns how things are. And although we might expect that all the commentators report the same view on the subject, actually their accounts differ in some interesting and illuminating ways.

Let me start with Eustratius who is at the centre of our inquiry. In the first five pages of his commentary on *APo.* II 19, Eustratius (257.3–8)²⁵ distinguishes art and science in the following way: science concerns eternal things (*tois aei echousin*), whereas art concerns things which hold for the most part (*tois hōs epi to polu*), i.e. the things which come to be and perish, since they consist of matter and constantly change. Hence, the universal in science always holds, i.e. the first principles of science always hold, whereas the first principles of art sometimes hold and sometimes may not hold.²⁶ On the other hand, there is a passage in his line by line commentary in which Eustratius (264.20–28)²⁷ presents alongside the

²⁵ τὸ δὲ καθόλου ἀρχὴ γίνεται τέχνης καὶ ἐπιστήμης, εἰ μὲν ἐν τοῖς ὡς ἐπὶ τὸ πολὺ, τέχνης, εἰ δ' ἐν τοῖς ἀεὶ ἔχουσιν ὡσαύτως, ἐπιστήμης. τὸ γὰρ καθόλου θεωρεῖται ἐν τε τοῖς ἐν γενέσει καὶ φθορᾷ καὶ οἷς μεθ' ὕλης τῆς ἀεὶ ῥεούσης ἢ ὑπαρξίς, καὶ ἐν τοῖς ὡσαύτως ἀεὶ ἔχουσιν, ἀλλ' ἐπ' ἐκείνων μὲν πταιστὸν τὸ καθόλου καὶ ποτὲ ἄλλως ἔχον ἢ περὶ κατείληπται, ἐπὶ δὲ τούτων ἀεὶ τὸ αὐτό.

²⁶ Eustratius draws a similar distinction later on, when he distinguishes between the different rational dispositions, but here science is juxtaposed to practical reason rather than to art; science, just like the intellect, deals with the eternal things and is always reliable, whereas practical reason which is involved in actions deals with the contingent and is sometimes right and sometimes goes wrong (269.10–21): τῶν δὲ περὶ τὴν διάνοιαν, τουτέστι τῶν λογικῶν ἔξεων, αἷς ἀληθεύειν πεφύκαμεν, ἡγοῦν καὶ γνωστικῶν αἱ μὲν ἀεὶ ἀληθεῖς εἰσιν, αἱ δ' οὐκ ἀεὶ ἀληθεῖς, ἀλλὰ παραδέχονται ποτε καὶ τὸ ψεῦδος· αὗται δὲ εἰσι δόξα καὶ λογισμός, ἡ μὲν περὶ τὰ θεωρητὰ ἔχουσα, ὁ δὲ περὶ τὰ πρακτὰ, ὅστις καὶ πρακτικὸς νοῦς λέγεται. ὁ γὰρ ἐν ἡμῖν λόγος περὶ τῶν πρακτέων ἐξετάζων καὶ λογιζόμενος καὶ τότε μὲν ἀποδοκιμάζων, τότε δὲ προαιρούμενος λογισμὸς λέγεται καὶ πρακτικὸς νοῦς, τὸ μὲν ὡς λογίσει ὑποβάλλον καὶ ἐξετάσει καὶ κρίσει τὰ πράγματα, τὸ δ' ὡς εἰς προᾶξιν ἀποτελεωτῶσαν ἔχων τὴν θεωρίαν. εἰσὶν οὖν αἱ δυνάμεις ἅμφω αὗται περὶ τὰ ἐνδεχόμενα καὶ ἄλλως ἔχειν, καὶ διὰ τοῦτο καὶ πῇ μὲν ἀληθεύουσι, πῇ δὲ ψεύδονται· ἡ δὲ ἐπιστήμη καὶ ὁ νοῦς πρὸς τὰ ἀναγκαῖα καὶ ἀεὶ ὡσαύτως ἔχοντα καταγιγνώμεναι ἀεὶ ἀληθεῖς εἰσι.

²⁷ τέχνην δὲ φησὶν ἢ τὴν περὶ τὰ γινόμενα ὑφ' ἡμῶν, καὶ ἐπιστήμην τὴν περὶ τὰ ὑπὸ τῆς φύσεως, οἷον ὅτι ὁ πέλεκυς τμητικός, τὸ δὲ ξύλον τμητόν, καὶ ὁ ἐλλέβορος

above distinction an alternative one: art is about what is made by us (*hyph' êmôn*), whereas science is about what is natural (*hypo tês physeôs*). And it is particularly interesting to note the examples which Eustratius uses to illustrate this alternative distinction between science and art. In the case of art he uses examples from carpentry, namely the axe which is able to cut the wood, and from medicine, namely the hellebore which is able to cure the human body from certain diseases of the spleen.²⁸ In the case of science he uses, apart from the usual example that the whole is larger than the part (257.12–14), the example that with the same velocity we traverse the same distance in the same time. Interestingly enough, this is the only occasion he uses this example; for Eustratius prefers to use as examples of first principles in science the metaphysical principle of non-contradiction (257.21–24; 268.25–27) as well as the mathematical example that two things equal to another thing are equal with each other (257.19–21; 268.23–24).

The fact that Eustratius uses an example from physics to illustrate the alternative distinction between science and art is, I think, quite suggestive of the reason why in the first place he chooses to introduce such a distinction. For if science does not only deal with eternal things, like in the initial distinction, but deals in general with what is natural, the criteria for science become less strict and physics can be included among the sciences. Besides, Eustratius (261.2–4)²⁹ also suggests that, apart from demonstrative science, there is also science which does not use demonstrations but divisions, analysis and definitions. Thus, if science is not only understood in the strict sense of demonstrative science, we could think that physics can be regarded as a science, even though it deals with the material things which by nature are contingent.

The same double distinction between science and art we find in Eustratius' commentary on the first book of the *Nicomachean Ethics*, although the motivation is different here; for in this commentary the issue is whether ethics, and for that matter politics, is a science or whether it is not

καθαριστικός, τὸ δὲ ἀνθρώπινον σῶμα καθαρὸν, καὶ ὅσα ἐν τοῖς ὑφ' ἡμῶν θεωρεῖται γινόμενοις· τὰ δ' ὑπὸ φύσεως γινόμενα δηλὰ ἐν οἷς ἀρχαὶ πλείους, ὅτι τὸ ὅλον πλεῖον τοῦ ἡμίσεος, καὶ ὅτι τὰ διὰ τοῦ ἴσου χρόνου τὸ ἴσον διάστημα διερχόμενα ἰσοταχῇ, καὶ ὅσα τοιαῦτα· ἡ τέχνην μὲν φησι τὴν περὶ τὰ ἔνυλα καὶ πταιστώτα, ἃ καὶ γένεσιν εἰρηγεν, ἐπιστήμην δὲ τὴν περὶ τὰ αἰεὶ ὡσαύτως ἔχοντα, ἃ καὶ ὄν ὠνόμασεν.

²⁸ The example of the hellebore is a very popular example with the commentators: e.g. Themistius, *In APo.* 63.17–23; Philoponus, *In APo.* 435.5–10; 21–27.

²⁹ τῷ δὲ οὐκ ἐνδέχεται ἐπίστασθαι προσέθηκε τὸ δι' ἀποδείξεως, ἐπεὶ ἐνδέχεται καὶ ἄλλον τρόπον ἐπίστασθαι, διὰ διατρέσεως, δι' ἀναλύσεως, δι' ὀρίσμου.

a science.³⁰ That is to say, in the context of discussing Aristotle's claim that in ethics we can indicate the truth about human actions only in general terms and roughly, Eustratius (21.28–31;³¹ cf. 15.3–23; 22.7–19) draws a clear distinction between art and science: science deals with the necessary (*anagkaion*), deriving necessary conclusions from necessary premisses, whereas art deals with the contingent (*endechomenon*), deriving conclusions which hold for the most part (*hōs epi to polu*) from premisses of the same kind. On the other hand, Eustratius (18.25–19.7)³² earlier in the same commentary says that, though the subject matter of ethics and politics concerns human actions which are not characterized by necessity, there is no reason to reject ethics or politics on such grounds as not scientific; for along these lines one would also need to reject rhetoric, grammar, dialectic, medicine and, in general, all the disciplines which deal with what is enmattered (*enula*), even the part of physics which deals with matter and what is enmattered. Hence, it is again interesting to note that in this discussion about the scientific status of ethics, physics is presented as the discipline whose scientific character should not be disputed, though its first principles and conclusions hold only for the most part.

It is not surprising that Themistius in his paraphrasis also presents this moderate position concerning the issue of what counts as science. Again in the context of trying to determine the cognitive disposition in virtue of which we come to have knowledge of first principles, Themistius (62.23–29; 65.8–9) claims that there is a strict sense (*akribōs*) of what a science is, namely demonstrative science, and another sense of 'science' in which science does not use demonstrations but, for instance, definitions. Moreover, in the context of distinguishing between the principles of science and those of art, Themistius (63.25–26) claims that art is concerned with what is made by human beings, whereas science is concerned with what is made by nature. Therefore, according to Themistius, too, physics should be regarded as a science, even if it is not demonstrative. The anonymous commentary (599.8–11; 601.8–17) presents exactly

³⁰ For a more detailed discussion of this issue, cf. Ierodiakonou (2004).

³¹ καὶ περὶ μὲν τὸ ἀναγκαῖον ἐπιστήμη καταγίνεται ἀναγκαῖα οὓσα καὶ ἐξ ἀναγκαίων ἀναγκαῖα περσίνουσα, περὶ δὲ τὸ ὡς ἐπὶ τὸ πολὺ ἐνδεχόμενον τέχνη, ἐκ τῶν ὡς ἐπὶ τὸ πολὺ προτάσεων τὰ ὡς ἐπὶ τὸ πολὺ συνάγουσα συμπεράσματα.

³² 19.1–7: οὐκ ἂν δὲ δικαίως τὴν ἡθικὴν τις καὶ πολιτικὴν ἀποπέμψαιτο μέθοδον εἰ τοιαῦτα περὶ αὐτῆς ἐπαγγέλλεται, ἐπεὶ γε οὗτος καὶ τὰς χαριεστάτας πάσας τῶν τεχνῶν ὡς μὴ καλῶς ἐχούσας ἀποβδελύσσεται, οἷον ῥητορικὴν γραμματικὴν διαλεκτικὴν ἰατρικὴν καὶ ἅπλως ἅπασας οὓσα περὶ τὰ ἔνυλα καταγίνονται, καὶ αὐτὴν τὴν φύσιν ὅση περὶ ὕλην ἐστὶ καὶ τὰ ἔνυλα, ὅτι μὴ ἀπταιστως αἰεὶ ἐνεργοῦσιν, ἀλλ' ἔστιν οὐ καὶ ἀποτυγχάνουσιν.

the same view: there is a more common sense (*koinoteron*) of science in which it is not demonstrative and concerns what is not made by human beings, i.e. both the eternal things and the things which come to be and constantly change, whereas art concerns what is made by us. Besides, when the anonymous commentator distinguishes in this text between science and art, he explicitly refers to physics as a science. It is only, then, in Philoponus' commentary on the *Posterior Analytics* that the distinction between science and art is drawn in such a way that physics cannot be a science; for Philoponus (436.8–12) claims that science is of the eternal things and art of those things which come to be and perish. Also, when he talks of the different rational dispositions, Philoponus (439.3–14) makes clear that it is practical reason and not science which deals with what comes to be and what is constantly changing. However, such comments do not exclude the possibility that Philoponus would also accept, just like the other commentators, a less strict sense of science. Indeed, Philoponus (439.23–29) himself once calls the knowledge of first principles a science, even though they cannot be demonstrated, and he once specifies, when he talks of science, that it is demonstrative science which he has in mind.

It seems, therefore, that the commentators side with Aristotle in thinking that physics is a science; for that is what Aristotle explicitly says in *Metaphysics* E1, when he groups together first philosophy, physics and mathematics.³³ That is to say, the commentators do not seem to share Plato's and the Neo-platonists' doubts about knowledge of the sensible world, but follow their usual trend in combining elements from the Platonic and the Aristotelian traditions. Eustratius, in particular, could be said to have a further motivation to prefer this attitude towards physics; for since the natural world is God's creation, studying nature may be thought by Christians as a way to find out more about God. But admittedly there is nothing explicit in the text to justify this speculation, plausible though it may be. On the other hand, at the beginning of his commentary on the *Posterior Analytics* Eustratius (10.27–29)³⁴ undoubtedly adds a Christian flavour to the topic of the knowledge of first principles, when he draws a line concerning our ability to understand the

³³ See, however, the distinction between physics and the theoretical sciences in *De partibus animalium* A1 639b30–640a2.

³⁴ εἰ δὲ βούλει, τὰ μὲν πρῶτα συγῇ ἐάσθων ὥσπερ ἐν ἀδύτοις ἱεροῖς ἀποκεκρυμμένα, τό τε αἶτιον ἐν καὶ τὰ ἐξ ἐκείνου δεικνυόμενά τε καὶ ἐκφαινόμενα, οὐ ποιοῦμενα οὐδὲ παραγόμενα.

world; for he talks here of the ultimate principles, the three persons of the Trinity, and claims that these cannot be known but should be left in silence like mysteries.³⁵

4. CONCLUSION

A.C. Lloyd in his short article "The Aristotelianism of Eustratius of Nicaea" made a rather sweeping claim, according to which: 'No one acquainted with late Byzantine Aristotle commentators will look for originality in their suggestions: such originality as there may be will be found in their style of exposition and their selection from traditional points of view' (p. 342).³⁶ I myself, on the contrary, think, and I hope to have here shown, that Eustratius' work provides us with a good example of a Byzantine commentary which contains philosophically interesting interpretations of an innovative character. For Eustratius does not blindly copy the previous commentators in their assessment of Aristotle's or of Plato's doctrines; it seems that in central epistemological questions, like the knowledge of first principles or the distinction between art and science, it is important for him to distance himself from both ancient philosophers and to suggest new theories which are in close agreement with his Christian beliefs.

³⁵ Lloyd (1987), 341–345 at 346 has rightly noted that the first principles here include the One Cause and the things which are revealed and manifested from it, neither created nor brought into being (οὐ ποιοῦμενα οὐδὲ παραγόμενα), a Christian formula referring to the second and third person of the Trinity.

³⁶ Lloyd (1987), 342.

ROGER BACON ON EXPERIMENT,
INDUCTION AND INTELLECT IN HIS
RECEPTION OF *ANALYTICA POSTERIORA* II 19

PIA A. ANTOLIC-PIPER*

Nowadays it is commonly acknowledged among scholars that the *Corpus Aristotelicum* had a huge influence on Latin medieval thinkers. It is equally agreed upon that the reception of the Aristotelian writings had a historical *point de départ* when, in the middle of the twelfth century, translators like James of Venice (Jacobus Veneticus Graecus) or Gerard of Cremona undertook the task of translating Aristotelian texts from Greek and Arabic, which were at the time unknown to the Latin medievals. In this light, the twelfth and thirteenth centuries are characterized historically by the translation and the reception of almost all Aristotelian works as well as other Arabic, Greek, and Jewish sources.¹

The fortunes of the Stagirite's doctrines on *being qua being* and natural phenomena, on man and happiness, on language and knowledge were to become quite different. Unlike the reception of *Physics*, *De anima* and *Metaphysics* (*Met.*), *Posterior Analytics* (*APo.*) had no institutional resistance to overcome.² By the middle of the thirteenth century, the Aristotelian paradigm of *scientia* (*epistêmê*) as demonstrative knowledge of reasoned facts had entered the philosophical and theological discussion. In 1255 *APo.* had become an integrated part of the arts-curriculum at the University of Paris.³ Nevertheless, its readers have had their difficulties with Aristotle's teaching on demonstration, universals, and principles. The sceptical remarks on the understanding and applicability of

* I would like to thank Dr. Mark Thompson for his help in revising my English.

¹ For the translators and the translations of the Aristotelian writings see: Dod (1982), 45–79.

² “Non legantur libri Aristotelis de methafisica et de naturali philosophiae, nec summe de eisdem, aut de doctrina magistri David de Dinant, aut Amalrici heretici, aut Mauricii hispanii.” *Chartularium Universitatis Parisiensis* (*CUP*), eds. Denifle & Chate-lain (1899), No. 20, 78 f. For the bans in the 13th century against Aristotle's work see: Van Steenberghen (1966) and Miethke (1976).

³ The 1252 *statutum artistarum nationis anglicanae* and the 1255 *statutum facultatis artium de modo docendi et regendi in artibus* in: *CUP* I, No. 201, 227–230 and No. 246, 277–279.

APo. that can be found in John of Salisbury's *Metalogicon*, a treatise from 1159, perhaps best express the attitude and the difficulties of a whole generation of scholars towards the *Scientia demonstrativa*: almost a century had to pass until the first medieval scholar undertook the task of commenting on *APo.*⁴ This diachrony in the translation and the reception of the Aristotelian writings extends over *Posterior Analytics* as well as *Metaphysics* and *Physics*. The finally fruitful integration of the 'New Aristotle' was furthermore promoted and supported by the mediation of the newly translated Arabic tractates and commentaries on Aristotle, and the reverting to traditional Christian sources like Boethius.⁵ The emergence of these writings as textbooks marks a continuity, rather than a discontinuity, between the twelfth and thirteenth century, as well as a strong motivational and systematic continuity in regard to the development of logical and epistemological, metaphysical or psychological questions.

Following the first translation of *APo.* into Latin (between 1125–1150) by James of Venice, it took almost a century until the first scholar undertook the task of commenting on this textbook of *Logica nova* as a whole.⁶ Although we find "echoes" of the *Posterior Analytics* in the reception of *Sophistici Elenchi* by the end of the 12th century,⁷ it was to be the later Bishop of Lincoln, Robert Grosseteste (1168–1253), who first commented on *APo.* in the 1220's in Oxford. By the end of the 13th century this literary commentary had advanced to a standard commentary.⁸ In the meantime we find more commentaries on *APo.* by masters from the

⁴ "Posteriorum vero analecticorum subtilis quidem scientia est, et paucis ingeniis pervia. Quod quidem ex causis pluribus evenire perspicuum est. Continet enim artem demonstrandi, quae prae ceteris rationibus disserendi ardua est. Deinde haec utentium raritate iam fere in desuetudinem abiit, eo quod demonstrationis usu vix apud solos mathematicos est, et in his fere apud geometras dumtaxat." John of Salisbury, *Metalogicon*, ed. Hall (1991), IV. 6, 145.

⁵ See Speer (1995), 6–11. For the reception of the epistemological doctrines of Aristotle in Dominicus Gundissalinus, a twelfth century author and translator, see Fidora (2003).

⁶ For the *translatio Iacobi* see: Minio-Paluello (1952), 265–304; Dod (1982), 45–79 and the "Praefatio" in Minio-Paluello & Dod (1968), IX–LXXXIII. Unlike the *translatio Iacobi* the other two translations from the Greek by the mysterious *translator Ioannes* (before 1159) and William of Moerbeke (ca. 1269 or earlier) and the translation from the Arabic by Gerard of Cremona (before 1187) were rarely used. While the *translatio Iacobi* is extant in 275 mss the other translations were far less circulated.

⁷ Ebbesen (2004), 69–92. For the reception of *APo.* in the Middle Ages see Serene (1982), 496–517; Pinborg (1984), 240–268; and De Rijk (1990), 104–127.

⁸ Robert Grosseteste, *Commentarius in Posteriorum analyticorum libros*, ed. Rossi (1981). See Ebbesen (1993), 129–178; here: 146f.

Parisian arts faculty as well as from the new orders.⁹ But, these few commentaries only partially reflect the whole spectrum of systematically discussed topics deriving from *APo*. The systematical discussions about the subject, the method, and the principles of a science extend to philosophical as well as theological contexts.¹⁰ In this sense, the question of how to apprehend the first principles of science is not only to be found in early philosophical commentaries on Aristotle's *De anima*, but also in theological tractates about the soul, indicating that there was a strong interest in epistemological and gnoseological issues.¹¹ In this milieu we come upon discussions which treat the cognitive capacities of the *homo viator* like sense and intellect, the nature and status of knowledge and the question of how to arrive at true knowledge.¹²

It was this philosophical, as well as theological, interest and challenge that led these scholars to a thorough discussion of the doctrine of the apprehension of the first, universal and immediate principles of understanding outlined by Aristotle in several passages in *APo*. and discussed in greater detail in the final chapter II 19. The ambiguity concerning the status of insight or intellect (*nous, intellectus*) and the relationship between sense-perception (*aisthesis, sensus*), induction (*epagôgê*) and insight, which has been discussed since the late ancient commentators until today, left room enough for various interpretations by the medieval scholars. One of the problems was whether Aristotle thought of *intellectus* as an intellectual process, as an act related to and being part of induction or as a mental state (*hexis-habitus*) where induction would play the constitutive role. In either case, the results of induction, this complex and multi-staged ascent from sensory perception of singulars to the

⁹ For example those by Robert Kilwardby, Nicholas of Paris, Albert the Great or Thomas Aquinas. See Tuninetti (1996), 67–93.

¹⁰ For the case of metaphysics see: Zimmermann (1998); for theology see Köpf (1974).

¹¹ "Quarum [operationes intellectus possibilis] prima est circa quidditates, secunda vero circa complexiones primas, que dicuntur principia scientiarum. Et primus intellectus dicitur intellectus in actu cum cognoscit quidditates; et dicitur tunc in actu quia tunc habet potestatem agendi ut cognoscat complexiones que dicuntur principia, sicut cognitio quid est totum et quid est pars, et quid est esse maius, consequenter cognoscitur hec complexio: omne totum est maius sua parte. Intellectus autem cognoscens huiusmodi principia vocatur intellectus in habitu. Cum ex hiis principiis infomatur intellectus in cognoscendo conclusiones vocatur intellectus adquisitus, qui alia ratione dicitur scientia." Anonymus, *De potentiis animae et obiectis*, ed. Callus (1952), 131–170, here: 158. See Tuninetti (1996), 99–106.

¹² For this systematic approach towards *APo*. see De Rijk (1990), 110f.; Marrone (1983) and (1986), 481–488.

apprehension of universals, were to be simple universal terms or concepts or universal propositions which in the reading of the medieval scholars should serve as principles of demonstration.

In the following I would like to shed some light on an interpretation of *APo.* II 19 which was presented at the arts-faculty in the 1240's, being part of the earliest courses on Aristotle's *Metaphysics* after the bans on reading or lecturing on Aristotle's writings in 1210 and 1215.¹³

In Roger Bacon (ca. 1214–1294) we find an Englishman who came to the young University of Paris to teach the *Libri Aristotelis* as a *magister artium*.¹⁴ During his stay at Paris (ca. 1237–1247) Roger left a respectable amount of question commentaries—the earliest fully developed ones in the thirteenth century.¹⁵ Although on *APo.* there is no commentary preserved, we can count among those Parisian commentaries two series on *Physics*, one commentary on *De sensu et sensato* and the Pseudo-Aristotelian *Liber de Causis* and not less than three series on *Metaphysics*.¹⁶

In his first lecture on *Met. A*, which is preserved in his *Questiones supra libros Prime Philosophie Aristotelis*, he might have had James of Venice's wording in mind, “De principiis autem, qualiter fiunt cognita et quis est cognoscens habitus [...]”,¹⁷ when he begins by asking whether knowledge (*scientia*) is innate or acquired.¹⁸ Evidently this introductory *dubitatio*,

¹³ *CUP* I, No. 11, 70f. and No. 20, 78–80.

¹⁴ For Roger Bacon's life and teaching career see Easton (1952), 35–66 and Hackett (1997), 9–24.

¹⁵ For the development of the medieval Latin commentaries see Ebbesen (1993), 138–141. Those question commentaries, a literary genus the thirteenth century inherited from the twelfth century, were treatises in which the author or lecturer raised questions (*queritur* or *dubitatur utrum*), presented contrasting and opposing opinions from tradition or contemporary authors, offered his own solution and responded to the opinions which were brought up.

¹⁶ The earliest ones are the *Questiones supra undecimum Prime Philosophie* (*Metaphysica* Λ); the second ones the *Questiones supra libros Prime Philosophie* [ed. Steele (1930)]; and the last ones, the *Questiones altere supra libros Prime Philosophie* [ed. Steele (1932)] written near the end of the 1240s. This latter work is hereafter referred to as *Questiones supra libros IV Prime Philosophie*. For the relative chronology of Roger Bacon's works see: Hackett (1997), 315–320. For Roger Bacon's and Robert Grosseteste's reception of *APo.* See Hackett (2004), 161–212.

¹⁷ Aristoteles latinus, *Analytica Posteriora*, 104.

¹⁸ “Primo dubitatur an scientia nobis innata est et non indigemus acquirere scientiam.” *Questiones supra libros Prime Philosophie*, 5. This approach of explaining Aristotle with Aristotle is not unusual among commentators. Concerning *APo.*, one could say that Roger seizes every literal opportunity to unfold the whole panorama of the *scientia Pos-*

which we can find in both commentaries on *Met. A* 1, places the following questions into the framework of *APo. II* 19: the problem of innatism (and precognition) addressed by Aristotle at the very beginning and at the end of *APo. A*. A few pages later we find another noticeable question which again affirms the impression that Roger is indeed dealing with the final chapter of *Posterior Analytics*, in this case with the second question: “Quoniam facta est mentio de habitibus anime, ideo queritur numerus et sufficientia habituum anime.”¹⁹

In my discussion of these *quaestiones*, treating the question of the cognition of first principles of science, I will concentrate on the epistemological and methodological aspects in regard to the “genetic epistemology” as Hamlyn put it,²⁰ consisting of the following four well-known stages of cognition: sense, memory, experiment and intellect, and induction as the fundamental intellectual operation.

1. THE PRINCIPLES OF SCIENCE

Apart from the questions on the ‘desire to know’ (*desiderium scire*)²¹ and the qualification of metaphysics as wisdom and as the highest speculative science, Roger Bacon’s distinctions concerning art and wisdom (*ars, sapientia*), sense and experience (*experientia / experimentum*) take by far the most place in his questions on *Met. I*. His approach towards the degrees of knowledge in *Met. I* 1 (980a27–981b13) is epistemological. He asks for the characteristics of these degrees and types of knowledge and relates each of them to the cognition of principles (*principia scientiae*). The degrees of knowledge as developed in *APo. II* 19 serve him as a model for epistemic ascent beginning with sense-perception, memory, culminating in experience and demonstration. In accordance with *APo.* as well as *Met. I* 9 (992b24–993a2) he asks whether knowledge (of principles) is innate or acquired.

teriorum: the demonstration *quia* and *propter quid*, or his understanding of the nature of principles whether they were definitions or axioms, *principia communia* or *propria*. See for example Bacon’s commentary on *Met. III* 2 where he discusses Aristotle’s aporia on the *apodeiktikê archê* (*principia demonstrativa*) in *Met. III* 2, 996b26–997a15 and *Met. IV* 3–8, 1005a19–1012b3. Bacon, *Questiones supra libros IV Prime Philosophie*, 113–129.

¹⁹ Bacon, *Questiones supra libros Prime Philosophie*, 14.

²⁰ Hamlyn (1976), 167–184.

²¹ For Roger’s treatment of the *desiderium scire* see Antolic (2004), 204–232.

In both commentaries his answers are well-reflected and point in the same direction: He refutes the idea of a simple innatism of knowledge in the broadest sense and even denies the opinion of some authors (*quidam dicunt*) that the human soul is created perfect and knowing but in the moment of the union with the body forgets virtues and science. He refutes theological objections, as well as the famous example from Alhazen's *Perspectiva* (*anima humana nata ad arguendum*) and Avicenna's theory of the influence of the intelligences on human cognition.²² Both his answers are reducible to the assertion that all knowledge is acquired because the human soul is created like an empty board on which nothing is yet written.²³ Although he emphasizes the importance and initial role of the senses, he does not explicitly combine these reflections with the Aristotelian motive of precognition pertaining to "all teaching and all intellectual learning" in his earlier *Questiones supra libros Prime Philosophie*.²⁴

²² Roger argues against Avicenna, "quod licet intelligentie sigillent nostras animas suis intentionibus, tamen nunquam perficietur intellectus noster, nisi cognoverimus prius suas operationes sensibiles quarum intelligentie sunt cause, et sic post apprehensionem operationum illarum cognoscuntur et apprehenduntur cause illarum operationum, et excitatur et vigoratur ad cognitionem intelligentiarum et substantiarum separatarum." *Questiones supra libros Prime Philosophie*, 7. For reference see Avicenna latinus, *Liber de Philosophia Prima sive Scientia divina* I–IV, ed. Van Riet (1977), 161–163. Although this refutation of the Avicennian theory on an impression of species into the human soul (*sigillatio et informatio*) belongs to the cognition of separate substances it is important to notice that in regard to the importance of sense-perception Roger is not willing to deviate from the Aristotelian esteem towards *aisthesis*. Not even in favour of Avicenna or Alhazen whose *Perspectiva* he also refutes. Roger claims that even our knowledge of separate substances and God has to begin a posteriori and has to be mediated by the knowledge of creatures. One reason for this extreme 'empiricism' is the weakness of the human mind to contemplate God directly, the other one is the theological idea of some eternal reward for the acquisition of virtues and knowledge. "Finis intentus hominis est felicitas, quam acquirit per meritum, et non mereretur per scientias et virtutes si haberet [scientia et virtutes] a natura; acquiritur ergo scientia homini per laborem doctrine et virtutis ut possit magis acquirere finis intentum." *Questiones supra libros Prime Philosophie*, 5. As a *magister artium* commenting on Aristotle's *Metaphysics* Roger Bacon never refers to the Holy Scripture. Nevertheless this theme fits perfectly into the Christian set of acquiring knowledge as it is stated in Rom. I:19.

²³ "Quod scientia nostra est acquisita, quia anima creata est sicut tabula nuda." Bacon, *Questiones supra libros Prime Philosophie*, 5. Apart from the fact that in Roger's Christian belief of course the human soul is created his answer refers to Aristotle's *De anima* III 5, 429b31–430a2 and the Stoic tradition (*tabula rasa*). As to the identity of the *quidam*: the source for the originally Platonic concept of *anamnesis* he might have found in Boethius' *Consolatio philosophiae*. See *De Consolatione Philosophiae, Opuscula Theologica*, ed. Moerschlini (2000), *Lib. V, c. 4*.

²⁴ In the later *Questiones supra libros IV Prime Philosophie* Roger's reply on the prob-

In his second question, Roger poses the question of whether the principles of science are acquired or innate. This passage is very important because it alludes to another chapter of *APo*. Concerning the knowledge of the ‘primitives’ (*ta prôta*), in Book I, chapter 3 (72b5–25) Aristotle refutes two objections according to which either knowledge (*epistêmê*) would be completely impossible, or that all knowledge would have to be gained by demonstration. Aristotle reaffirms that,

(T1) neither is all understanding demonstrative, but in the case of the immediates it is non-demonstrable—and that this is necessary is evident; for if it is necessary to understand the things which are prior and on which the demonstration depends, and it comes to a stop at some time, it is necessary for these immediates to be non-demonstrable. [...] and we also say that there is not only understanding but also some principle of understanding (*archên epistêmês*) by which we become familiar with the definitions (*horos*).²⁵

When Roger Bacon asks whether the principles of knowledge (*scientia*) are innate or acquired he is alluding to the ambiguity in the word principle (*archê*), since principle refers to the beginning, insofar that the premises of demonstration are immediate (*amesôn*), as well as to *nous* as the beginning of understanding. In his answer Roger claims that there can be no infinite regress in cognition but there has to be a beginning of knowledge which is innate (*unigenitus*). But, there are two kinds of principles and neither of them are principles *qua* premises. The beginning—one could say, the *conditio sine qua non* for Roger—is sense-perception and memory. So, although the soul is created like an empty board in

lem of innatism is somewhat more detailed than in the earlier *Questiones*. “Dicimus igitur quod de scientia dupliciter est loqui; uno modo ut per hoc quod est scientia nascatur anime dispositio vel affectio inclinans animam ad boni affectionem et veri speculationem, et hec est scientia imperfecta et confusa, et hec est innata; alio modo contingit loqui de scientia prout nominat habitum completum. Et hec est duplex; quedam est principiorum, et hec est completissima quia est per causam intrinsecam, cognoscuntur enim principia per diffinitionem suorum terminorum; alia est conclusionum, et hec est completa non completissima, unde principium ad scientia, homini innatum est, scilicet definitivum, set complementum scientie.” Bacon, *Questiones supra libros IV Prime Philosophie*, 9. Of course cognition starts with perception but before one actually starts to learn the human soul is in a potential state towards knowledge and has a natural desire (*appetitus*) for knowledge. Both, desire and knowledge, are innate. This kind of innate knowledge, however, is incomplete and confuse. *Scientia sensu stricto* remains to be an acquired state. For a more detailed treatment see: Bacon, *Questiones supra libros VIII Physicorum*, 7–12.

²⁵ *APo*. I 3, 72b18–25 (tr. Barnes 1975).

regard to knowledge, it possesses a beginning in the form of innate faculties by which all learning can commence. The other group of acquired principles of knowledge consists of experiment, universals and admiration.

(T2) *QUERITUR utrum principia scientie sint innata vel acquisita. [...] CONTRA: si sint acquisita et non sunt per naturam, tunc queritur de illis per que acquiruntur, utrum acquirantur vel non. Si sic, ergo est abire in infinitum; si non, ergo standum est in aliquo, qua ergo ratione in secundo et in primo, quare erunt innata. SOLUTIO: principia dupliciter; aut originalia et radicalia, et hec sunt innata, que sunt sensus et memoria: aut sunt completiva, et hec sunt acquisita, et hec sunt immediata, scilicet, experimentum, et universale, et admiratio.*²⁶

Of course, *sensus* as a principle of knowledge is meant as a faculty (*potentia*); it is innate and it is a necessary prerequisite for acquiring knowledge.

(T3) *CONTRA: deficiente sensu deficit scientia quae est secundum illum sensum, ergo deficiente sensu simpliciter et deficit scientia simpliciter, quare, etc. SOLUTIO: non est ponere scientiam sine sensu vel memoria, imo necesse quod aliquo modo precedat sensus.*²⁷

In *APo.* II 19, *aisthêsis* is characterised as being a certain *dynamis sumphutos kritikê*. That universal concepts (*universalia*) are immediate, although acquired, namely by induction from singulars to universals, is doubtless. So far, Roger's terse recapitulation meets Aristotle's explanation. Nevertheless Roger's remarks on the innate and acquired principles seem a bit odd because one main aspect is missing. In Robert Grosseteste's commentary on *APo.*—a commentary which Roger was not only aware of but also used—we find the concise and instructive explanation of the intellect as a principle of knowledge.²⁸ Indeed Roger could have read this explanation about the role of the intellect as the principle of science in the translation of *APo.* as well as in Grosseteste's commentary. But these remarks are the first, but not the last, ones which lack a definite statement about the role of *intellectus*. From this passage one could conclude that the intellect, be it the process of insight or the mental state in which the soul apprehends the first principles, is neither an innate nor an acquired principle of science.

²⁶ Bacon, *Questiones supra libros Prime Philosophie*, 6.

²⁷ Bacon, *Questiones supra libros Prime Philosophie*, 7.

²⁸ "Erit igitur intellectus principium scientie et principium principiis et principium acceptivum principiis." Grosseteste, *Commentarius in Posteriorum Analyticorum*, 407.

On the other hand he obviously cannot reduce all cognitive processes to perceptive phenomena; yet, Roger seems to attempt to marginalize the role of sense-perception. Unlike Aristotle's high regard for *aisthêsis* as an irreducible type of knowledge (*Met.* I 1, 980a21–27), Roger's esteem for *sensus* seems to be limited to its subsidiary relevance in being the occasion of science rather than the cause.²⁹ In view of Aristotle's epistemology he uses the Augustinian distinction of the *ratio inferior* and *ratio superior*—the intellect in Bacon's reading—and the doctrine of the two faces of the soul in order to fill this gap.³⁰ As a consequence, the intellect (*ratio superior*) is independent of bodily conditions and does not require the aid of the senses in its operations. The *ratio inferior*, *ratio sensu stricto*, perishes with the body and is dependent of the sense organs and sense-perception.³¹ Intellect and *ratio* are mutually related and are, as parts of the soul which is *forma corporis*, related to the body *sine medio*.³² In this series of questions, one must face that Roger does not come to a

²⁹ "Sensus est causa disponens et administrans et non perficiens, de qua ratio procedit." Bacon, *Questiones supra libros IV Prime Philosophie*, 12.

³⁰ This distinction was Arabic in origin and was received in the writings of Algazel and Avicenna and by the Latin translator of Avicenna's *Liber de Philosophia Prima* and Algazel's *Metaphysica* and *Logica*, the archdiacon of Cuéllar Dominicus Gundissalinus (ca. 1110—died after 1190). See Fidora (2003), 12f. and Rohmer (1927), 73–77.

³¹ "DICENDUM quod homo ex duabus materiis constat, secundum quas elevetur, ex carne scilicet et ossibus, et anima cum ratione; set hec ratio duas habet portiones, unam ad superiora, per affectum scilicet et aspectum ad bonum inpermutabile spirituale, et quantum ad hanc est anima non perversa set recte ordinata, quia sensualitas subcumbit se rationi et ei obedit: et quantum ad hanc dicitur quod 'omnes homines natura scire desiderant'; alia est portio vel pars rationis, secundum quam anima deprimitur ad bonum mutabile, scilicet ad inferiora, et secundum hanc, ratio in sensibilibus detinetur, et sensualitas ei dominatur, et tunc anima est inordinata et perversa, et pars inferior et vilior dominatur superiori et nobiliori, et per istam portionem vel partem inferiorem non desiderant homines scire, set potius ad vitia et ignorantias confugiunt." Bacon, *Questiones supra libros IV Prime Philosophie*, 2f.

³² Bacon, *Questiones supra libros IV Prime Philosophie*, 9. In his first commentary on *Met.* A the dualistic tendency is even more pronounced: "QUERITUR hic primo utrum intellectus corrumpatur corpore corrupto [...]. SOLUTIO: ad hoc dicendum quod de anima intellectiva est loqui dupliciter; uno modo in quantum est forma, et hoc modo est actus corporis et sic non est separabilis, et hoc modo correlative determinatur [...]; alio modo in quantum est essentia vel substantia; et hoc modo est hoc aliquid, et hoc etiam modo duplici in quantum potentialis, et hoc modo proprie naturaliter est, et sua operatio que est intelligere sic per administrationem fantasmatum et sic est corruptibilis, et de illo quod intellectus corrupto quodam inferiori, id est fantasmate a quo dependebat; alio modo in quantum est agens et sic non est proprius anime conjuncte corpori set separate; non enim intelligit per administrationem fantasmatum set per completam reductionem ad essentiam suam et exemplaria similiter intelligere non corrupto, set quoddammodo innovatur." Bacon, *Questiones supra undecimum Prime Philosophie*, 14–16.

convincing solution in regard to the cooperation between perception and intellect but rather gives a provisional answer.

In order to leap this persisting systematic gap he requires a coherent theory which enables him to explain how man, commencing with sense-perception, can form reliable true universal terms or concepts and, in a second step, universal propositions. To my understanding his approach consists of two different but not mutually reducible doctrines. In a chronologically first and important step in regard to the question of the apprehension of principles, he adopts Robert Grosseteste's interpretation of induction in order to show how man apprehends principles of science qua propositions and axioms.

In his later *Questiones altere supra libros [IV] Prime Philosophie* he describes via abstraction how to overcome the hiatus between senses and *ratio*.³³ Although it is not unusual among the medievals to use the doctrine of abstraction, as developed in *De anima* III 4–8, in order to explain the formation of first rudimental concepts, this approach is not transferable to Bacon's rather methodological approach. Although he describes the process of abstraction along the lines of *De anima* he avoids committing himself to a definite answer about the object of abstraction as well as induction. In both cases it is the idea of the 'denudation' of the individual object's species (form) from its material condition which is important to him. In Roger's treatment of the apprehension of principles in his earlier *Questiones supra libros Prime Philosophie* we find neither a consideration of the object of induction nor any reference to the abstraction of a species or intention in the mind. The universal gained by abstraction (*forma* or *species abstracta ab particularibus*), i.e. the intelligible form, is not the kind of universal that science can refer to. The scientific universal has propositional character and its formation cannot depend on abstraction

³³ In his last lectures on *Met. A*, Roger defines sense as a *potentia intermedia* which is receptive (*susceptiva*) for the *species sensibilis*, the intelligible form in the material object. "Causa autem ordinationis sensus et intellectus est quia immaterialis intelligentia, objecta autem materialia sunt, oportet esse mediam inter ista que sit partim materialis, scilicet quantum ad organa, et partim immaterialis, scilicet in se, et hec est sensus, deinde huiusmodi species existentes in sensu in fantasia vel ymagine recipiunt, et hoc per maiorem depurationem et denudationem a materia vel conditionibus materialibus et ipsi intellectui possibili repressantur, et deinde intellectus agens irradians supra fantasmata ipsa penitus depurata a conditionibus materialibus et intellectui possibili reponit et de potentia intelligibile facit actu intellectum, et ita gradatim fit ascensus magis ac magis depurando." Bacon, *Questiones supra libros IV Prime Philosophie*, 12; 37f.

alone.³⁴ But, apart from the laconic remarks that sense-perception is concerned with singulars whereas experiment is concerned with the apprehension of something common in many singulars (*acceptio in pluribus singularibus, universale in omnibus*) one has to notice the lack of a thorough consideration of the object of induction.

Roger Bacon treats the problem of the ontological status of universals in his earlier commentaries on Aristotle as well as in his later *Communia Naturalium*.³⁵ His terse remarks on singulars and universals being objects of induction have to be seen from the perspective of his extreme realist position concerning the doctrine universals as common natures in individuals as well as intentions in the mind. So, the reason for this reserve is not only a question of interest but of literary and systematical context. In his solution on the question of whether the universal is something that exists only in the mind or in extra-mental things, Roger Bacon claims that there are two kinds of universals. The universal *sensu stricto* is the one common nature in many individuals (*unum in multis*). The universal concept in the mind is described by him using many terms. Among those we find the term *intentio*, deriving from the Arabic logic tradition, *ratio* and *similitudo*.³⁶ Roger Bacon is indeed following the idea that universal terms and propositions which are part of, or perform as, premises in demonstrations would have to undergo a different—maybe more complex—procedure than mere abstraction. We even find a brief discussion of this issue:

³⁴ “Ad aliud, universale dupliciter; aut forma abstracta ab particularibus, et sic non est scientia universalium; aut universale, id est, propositio universalis secundum quod principium vocatur universale.” Bacon, *Questiones supra libros Prime Philosophie*, 16.

³⁵ See Bacon, *Questiones supra libros Prime Philosophie*, 239–246; Bacon, *Questiones supra libros IV Prime Philosophie*, 137–159 and Bacon, *Communia naturalium* I 1–2, ed. Steele (1905 [?]), 92–107.

³⁶ “QUERITUR ergo quomodo ponendum est universale, an in rebus vel in anima solum. [...] CONTRA: sicut dictum est, particulare se habet ad sensum ut universale ad intellectum set sola species particularis et similitudo est in sensu, ergo similiter sola similitudo vel species universalis erit. QUOD CONCEDO, set multiplex universale; quoddam est quod est vere predicabile de rebus et istud non est in anima; aliud est universale quod est species et similitudo universalis veri, et vocatur et est in anima, et duplici de causa vocatur universale, tum quia est similitudo veri universalis quod est res, tum quia est similitudo ex consequenti omnium universalium, et est commune plurium non via predicationis set sicut exemplar respectu exemplarum.” Bacon, *Questiones supra libros Prime Philosophie*, 241. See for a discussion of Bacon’s doctrine of universals and the discussion of his moderate or extreme realism Crowley (1951–1952), 264–275 and Maloney (1985), 807–837 and (1989), especially 7–11. Here I would like to express my gratitude to Professor Thomas Maloney (University of Louisville) for the advice he gave me towards Roger Bacon’s treatment of universals.

(T4) *ITEM: primo Methaphysice Argazelis, universale non est in singularibus, set in intelligibilibus, et similiter in fine Posteriorum et primo Veteris Methaphysice, ex multis memoriis fit unum experimentum, ex experimento multotiens facto derelinquitur in anima universale, quod est ens unum preter multa etc. [...] AD RATIONES Aristotelis, quia equivocatur universale, quia universale est aliqua natura duplex; sive sit res sive similitudo, et de tali non loquitur ibi; aliud est universale quod est propositio universalis immediata, ut 'omne totum est magis sua parte', et supra tale fundantur scientie et artes. Unde tale universale est principium complexum, et est solum opus anime, quia propositio est opus anime, et de tali non loquimur hic.*³⁷

Here we also find the confirmation that Roger is indeed reading *APo.* II 19 as a theory of how to methodologically explain the apprehension of principles *qua* universal propositions.³⁸ Science is about—and commences with—propositional universals such as axioms, and it proceeds via demonstration. The following section is devoted to the description of how Roger would have the reader become familiar with these principles.

2. INDUCTION AS COGNITIO ET PROBATIO

The question here is how Roger explains induction (*epagôgê*), after excluding innatism as well as the Avicennian kind of *informatio-illuminatio*, by emphasising the role of 'empirical' faculties. Roger turns to the degrees of knowledge as described by Aristotle in *Met.* I 1 and in the first passages of *APo.* II 19 [99b35–100b12] along epistemological lines. The implicit guiding question is about the ascent from the perception of singulars to the cognition of universals terms and formation of universal propositions. He begins with the conglomeration of sensations (*collatio sensus*) and memories, up to the third and acquired principle of science, the *experimentum*: "quia multe memorie faciunt experimentum, ut dicit in libro *Posteriorum*."³⁹ While senses and memory are concerned

³⁷ Bacon, *Questiones supra libros Prime Philosophie*, 241 f.

³⁸ His conviction about the confused character of the first cognition of the soul, in regard to the species found in 'particulars', could point in a similar direction. Bacon, *Questiones supra libros VIII Physicorum*, 3–12.

³⁹ Bacon, *Questiones supra libros Prime Philosophie*, 9. The *translatio Iacobi* indeed gives *experimentum* for *empeiria* and from the technical vocabulary one can conclude that Bacon has used this translation rather than the *translatio Gerardi* and that he is working very closely to the text. "Ex sensu quidem igitur fit memoria, sicut diximus, ex memoria autem multotiens facta experimentum. Multe enim memorie numero experimentum est unum. Ex experimento autem aut ex omni quiescente universali in anima, uno preter multa, quodcumque in omnibus unum sit illis idem est, artis principium et scientie [...]" Aristoteles latinus, *Translatio Iacobi*, 105 f.

with the perception of the so-called *singularia*, it is *experimentum* which is concerned with the forming of universal concepts. Through multiple and repeated memories of the same thing, our mind grasps or forms one *experimentum*, a primitive, rudimentary universal (*katholou*) concept which is based on—but already transcends—the level of singular undifferentiated impressions:

(T5) *quando fit cognitio de pluribus singularibus quod hoc profecit illi et illi [...] quia experimentum est acceptio in pluribus singularibus, universale in omnibus.*⁴⁰

Experimentum, as it is written, is a distinct cognition of singulars and only human beings have this kind of cognition. It is a knowledge by which we know something common to many singulars. So far, Roger's recapitulation of *experimentum* resembles the Aristotelian notion of *empeiria*. *Empeiria*, as Aristotle explains in *Met.* I 1, is factual knowledge (*gnôsis tôn kath' hekaston*), the knowledge that (*hoti*) something is the case which enables to judge over single cases.⁴¹

In the following *quaestiones* Roger introduces three kinds of principles, each of them recognized in a different way, though in all of these three cognitive operations experiment forms a constitutive part. Until this point Roger still does not mention induction explicitly as the fundamental epistemic operation but exceptionally refers to *experimentum*. This *experimentum* rather than *experientia*, as Roger distinguishes thoroughly, is described as a specific way of cognition, namely as a reception of singulars collated under some aspect of universality in which they communicate. This method of cognition is actually a primary part of induction. Furthermore Roger speaks of *experimentum* as a mental

⁴⁰ Bacon, *Questiones supra libros Prime Philosophie*, 8. Jeremiah Hackett correctly emphasizes that Roger Bacon distinguishes thoroughly between *experientia*, which is "the distinct knowledge of singular things," and *experimentum*, which is "a knowledge (science) of principles. Animals do not have it. Because it involves the reception of singulars under some aspect of universality." Hackett (1998), 101–120; here: 109.

⁴¹ Aristotle, *Metaphysics* I 1, 981a16. The problem of how to interpret the function of *empeiria* in the four stages of cognition adequately is discussed in Barnes' notes on chapter 19 (see Barnes (1975), 253) as well as in great detail in Detel's commentary on *APo*. Detel (1993, 832f. and 873) distinguishes between two kinds of experience—elementary and complex—and comes to the conclusion that experience bears at least two significant characteristics. At the stage of experience the singular and universal aspects of the so-called *qualia* are separated for the first time on a linguistic level in the form of singular propositions. The similarity of singular facts are described in a way that their universal structures are recognized explicitly. This is the reason why experience marks the step—the first stand or fixation—from singular to first, but rudimentary universals.

state, meaning the possession of a certain knowledge, i.e. of universals. This way of perception and this kind of knowledge is supposed to be the immediate way to art and science because it does not proceed via demonstration. Experimental knowledge is, as Roger concludes, after sensory perception and repeated memories, an acquired principle of science which in its immediacy meets the requirements of the premises of demonstration. It marks the beginning of science wherefrom demonstration can progress. Roger Bacon's *experimentum* is the principle, i.e. the beginning of invented (*inventio*) and taught (*doctrina*) science and it is this fundamental concept of experience which becomes important in the following passages.⁴² As mentioned before, Roger's description of concept formation follows inductive, rather than abstractive, lines. Although in Aristotle's *De anima* we find a parallel between induction and abstraction in regard to the cognition of the intellect via phantasms,⁴³ Roger seems to deviate from this theory and claims that the form we perceive by abstraction is not the universal concept entering into demonstration. That this is a problem belonging to the widely discussed topic of the cognition of singulars, to his understanding of universals and his extreme realism, has already been pointed out.⁴⁴

The first principle he outlines concerns the immediate apprehension of the middle term (*meson*, in Latin *medium*) by quick-wittedness (*anchinoia*, in Latin *sollertia*) introduced by Aristotle in *APo.* I 34. In this case, where the cause of a phenomenon is obvious, induction is permitted from one single case: one *experimentum* is sufficient. In his later enumeration of the *habitus* of the rational soul we find *sollertia* explicitly referred to as a *habilitas* or *dispositio* by which we find the middle term.⁴⁵

⁴² In Roger's later commentary it reads as follows: "Alia est experientia que est universalis acceptio singularium, universalitate temporum et subpositorum sub una natura communi contentorum eam causante, determinante necessitate, et hec non fallitur, et hec est propria, et hanc habere multum est difficile, et hec proprie est principium scientie et immediatius." *Questiones supra libros IV Prime Philosophie*, 18. For the various kinds of experience in Roger Bacon's thought see Hackett (1998), 101–120 and (1995), 195–227, and Antolic (2004), 213–237. For the history of experiment and experimental science see Crombie (1953).

⁴³ Aristotle, *De anima* III 8, 432a3–14.

⁴⁴ See note 35 above.

⁴⁵ "QUERITUR septimo an unica memoria faciat experimentum. [...] experimentum potest esse de aliquo ubi causa manifesta est, et sic sufficit unica memoria, ut quod ignis comburat sufficit unicum experimentum vel memoria." [...] "Si sit [habitus] cause, hoc est dupliciter; aut est habilitas et dispositio ad inveniendum medium, et sic est sollertia." Bacon, *Questiones supra libros Prime Philosophie*, 9; 19.

The other two remaining principles of science are recognized via a *cognitio simplex* and a method described as *inductio et probatio ad sensum*.

(T6) *QUERITUR adhuc de experientia et experimento, utrum experimentum sit principium necessarium ad scientiam. Quod non videtur: [...] ITEM: propositiones universales que sunt principium artis et scientie cognoscuntur per inductionem et demonstrationem et per terminos; set experimentalis cognitio non est inductiva nec est demonstratio, quia nec propter quid, nec est in quantum terminos cognoscimus, quare experimentum non est principium universaliter necessarium ad artem et scientiam. CONTRA: Aristoteles non est diminutus; set non determinat aliquae principia deveniendi ad scientiam nisi experimentum et sensum et memoriam et universale et admirationem. [...]*

AD ALIUD RESPONDEO, cognitio de principiis habenda potest esse dupliciter; aut potest haberi quantum ad probationem et cognitionem ipsorum principiorum inventorum—et hoc dupliciter; aut quantum ad simplicem cognitionem; et hec habetur in quantum terminos cognoscimus et diffinitiones terminorum, aut quantum ad probationem, et hoc via probationis ad sensum et sic per inductionem—aut via probationis ad intellectum. Et sic est dupliciter; aut demonstratione quia, aut demonstratione propter quid.

*Possumus loqui de cognitione principiorum prout sunt in inveniando, et sic experimento cognoscuntur.*⁴⁶

Roger asks whether *experimentum* is a necessary principle of science and contrasts this kind of cognition with the cognition of terms, with induction and two types of demonstration. It is noticeable that Roger, once again, does not mention the intellect as a necessary reference-point in the inductive process. The principle of science he has in mind here is not intellect as the principle of science but principle as the counterpart to conclusion, “that from which a thing can first be known—this also is called the beginning of the thing, e.g. the hypotheses are the beginnings of demonstrations.”⁴⁷ Instead he stresses the importance of *experimentum* at the beginning and at the end of his question so that in consequence one could conclude that Roger’s *cognitio experimentalis* is basically identical with induction from singulars to universal genera and species, subject- and predicate-terms, and universal propositions. Experimental cognition would be the generalising cognitive ascent from singulars to universals.

⁴⁶ Bacon, *Questiones supra libros Prime Philosophie*, 9f.

⁴⁷ Aristotle, *Metaphysica*, ed. Ross (1928), V 1, 1013a14–16.

Indeed Roger introduces another element from Aristotle's theory of the principles of knowledge. In order to explain how we grasp principles he refers to *APo.* I 3 (72b18–25) where Aristotle states “that there is not only understanding but also some principle of understanding by which we become familiar with the definitions [*horous*].”⁴⁸ This *archên epistêmês* aims at *nous* as the principle of science. What we find in Rogers quotation is not only a gnoseological modification towards experiment insofar as we apprehend principles by recognizing their terms. It is also one of the first occasions a medieval author introduces this topic in order to explain the apprehension of principles. One can reasonably conclude that Roger's source for the concept of *cognitio principiorum in quantum terminos cognoscimus* was James of Venice's interpretation of Aristotle's ambiguous Greek expression *horos*:

(T7) *Nos autem dicimus neque omnem scientiam demonstrativam esse sed immediatorum indemonstrabilem. Et hoc quod necessarium sit, manifestum est; si enim necesse est quidem scire priora et ex quibus est demonstratio, stant autem aliquando immediata, hec priora indemonstrabilia necesse est esse. Et hec igitur sic dicimus, et non solum scientiam, set et principium scientie esse quoddam dicimus, in quantum terminos cognoscimus.*⁴⁹

Roger refers to this process as *cognitio simplex*. Although he does not mention any example which could elucidate this rather short explanation, this simple cognition seems to be marked by a certain self-evidence. Doubtlessly he is not referring to simple universals—*incomplexa*—but to a certain mode of cognition by which we recognize axioms (in Latin *dignitas*), the common (*koina*) principles of science. In his commentary on *Met.* III 2 we find him enumerating various axioms which are described

⁴⁸ *APo.* I 3, 72b23–25 (tr. Barnes 1975).

⁴⁹ Aristoteles Latinus, *Analytica Posteriora*, *Translatio Iacobi*, 10. Luca Tuninetti presents this doctrine in terms of its Aristotelian root, its late ancient reception by Themistius and Philoponus and its translation by James of Venice. He points out that Thomas Aquinas had been the first medieval commentator who in this context succeeded in presenting a coherent interpretation of intellect as the principle of science and the assertion of the cognition of terms. “Necesse est scire priora, ex quibus est demonstratio; set haec aliquando contingit reducere in aliqua immediata. [...] Ipsa autem principia immediata non per aliquod medium extrinsecum cognoscuntur, sed per cognitionem propriorum terminorum. Scito enim quod est totum et quid est pars, cognoscitur quod omne totum est maius sua parte: quia in talibus propositionibus, ut supra dictum est praedicatum est de ratione subiecti. Et ideo rationabiliter cognitio horum principiorum est causa cognitionis conclusionum: quia semper, quod est per se, est causa eius, quod est per aliud.” Thomas Aquinas, *In Aristotelis Libros Posteriorum Analyticorum expositio*, ed. Spiazzi (1964), Lib. I 7, 171. See: Tuninetti (1996), 46–48; 119f.

as being indemonstrable because they are *per se nota*.⁵⁰ In regard to the *diffinitiones terminorum*, one is left to significantly develop his remarks in order to arrive at definitions which possess explanatory power and therefore could serve as premises of demonstration. We recognize and comprehend axioms simply by recognizing terms and the meaning of these terms. Thus, by *diffinitio terminorum* Roger intends to emphasise that the cognition of axioms is grounded on the understanding and the fixation of the meaning of linguistic expressions. Of course he does know about definitions *sensu stricto* as principles of science.⁵¹ Based on my reading, he just wants to allude to two different methods of apprehending principles: an intuitive, simple apprehension of principles *per se nota* i.e. principles known by terms, and a somewhat more complex, maybe discursive method. So, in this passage he restricts the cognition of the meaning of terms (*horous*) to the cognition of axioms and not, as we find it in modern

⁵⁰ In his commentary on *Met.* III 2 (996b26–997a15) Roger treats the problem whether the principles of demonstration themselves were to be demonstrated. In his discussion of the pros and cons he refers to the Boethian axiomatic tradition to reaffirm that the principles, i.e. the premises of demonstration cannot be demonstrated: “si contingeret ista demonstrare, tunc est abire in infinitum, quod est inconveniens. [...] Nihil quod est per se notum indiget demonstratione vel necessitate; principia demonstrationis sunt huiusmodi. [...] cum per se maxime sunt nota, ergo ipsa non contingit demonstrare.” [...] “Principium demonstrationis aut est extrinsecum, scilicet secundum virtutem, aut est intrinsecum, scilicet secundum substantiam. Si primo modo, scilicet secundum virtutem, dupliciter; quia aut est indemonstrabile, quia per se notum est et communis animi acceptio, et sic est dignitas ut ‘de quolibet affirmatio’ [vel negatio, et non simul], et ‘omne totum majus est sua parte’, et ‘quaecunque uni et eidem sunt equalia inter se sunt equalia’, et huiusmodi.” Bacon, *Questiones supra libros IV Prime Philosophie*, 121 f.; 125 f. An additional explanation for the necessary indemonstrability of the principles of demonstration he evidently has found in Boethius’ *opusculum De hebdomadibus* and in his works on Aristotle’s and Cicero’s *Topics* (*De differentiis topicis libri quattuor* and *In Topica Ciceronis Commentariorum libri sex*). In these works Boethius (480–524) not only offers Latin translations for Aristotelian terms, such as axiom (*axiomata-maximae propositiones* or *propositiones per se nota*) or term (*horos-terminus*) but also combines Euclidian and Aristotelian doctrines on principles. Unlike the *Posterior* or *Prior Analytics* these works were known to the scholastic authors through all the centuries since then and Boethius’ epistemological theories on principles or the division of sciences have had a huge influence on the epistemological debates in the twelfth century. His *communis animi conceptio* (*est enuntiatio quam quisque probat auditam*) was interpreted by the medievals as an axiom or *dignitas* and served as a pattern and starting-point for reflections on knowledge and science, as it is the case in the *Regulae caelestis iuris* by Alan of Lille. In Roger Bacon’s treatment of principles as well as other topics we can see that Aristotle’s work was interpreted along with that of Boethius’ and we have another proof that neither was Boethius simply replaced by Aristotle nor that Aristotle or Boethius were the only sources for epistemological reflections. See: Schrimpf (1966); Burnett (1988), 151–166; Dreyer (1996); and Tuninetti (1996), 48–93.

⁵¹ Bacon, *Questiones supra libros IV Prime Philosophie*, 124–128.

translations, to the grasp of definitions or, as Barnes points out, to the grasp of all the principles of science.⁵²

I suppose that one possible source for his characterisation of the cognition of axioms has been Robert Grosseteste's commentary on *APo.* I 10 (76b23).⁵³ In his remarks on the three requirements of science of demonstration, Grosseteste lists suppositions and postulates and amplifies the missing third element needed in demonstration. What is possessed because of itself (*di'auto*) is *per se manifestum* or *notum* and is called a *dignitas*. He emphasises that an axiom is self-evident and does not need any further explanation or reason. They are not recognised by discursive cognition but some kind of simple intuition. In Grosseteste's reflections on axioms we again find various epistemological traditions. Apart from Boethius' *communis animi conceptio* we can identify another Christian author who was very important for Grosseteste as well as for Bacon. The expression *aspectus mentis* belongs to Augustinian psychology; it stands for the faculty of reason and derives from St. Augustine's *Soliloquia*.⁵⁴

(T8) *Dicit ergo quod illud quod habet propter seipsum et non per medium necessitatem ut sit et ut manifestum sit apud omnem intellectum non est suppositio neque petitio, sed est dignitas, quia quod tale est quod ipsum per se est et per se manifestum est non eget ratione vel sillogismo exteriori ostendente illud esse vel aliquo modo explanante illud esse. [...] Dignitas autem non eget nisi ratione que sita est in anima; sicut visus in oculo et sicut lucidum visibile ad hoc ut videatur non eget nisi visu exteriori cadente super ipsum, sic dignitas ad hoc ut sciatur non eget nisi ratione, que est aspectus mentis, simpliciter super ipsam cadente et nullo modo explanante ipsam.*⁵⁵

I hope that this reference to Aristotle and Robert Grosseteste can provide an explanatory background for Roger Bacon's quite short remark regarding the cognition of axioms.

Still, there is one kind of principle missing. Primarily, I find there is a lack of consistency between Aristotle's concept and Roger's interpretation of *epagôgê* and *empeiria*. In fact, Roger's explanation seems to

⁵² Barnes (1975), 108f.

⁵³ *APo.* I.10, 76b23–24 (tr. Barnes 1975): "What necessarily is the case because of itself and necessarily seems to be the case is not a supposition or a postulate."

⁵⁴ Augustinus, *Soliloquia* I, cap. 6, 13, MPL 32, 869–906, here: 876.

⁵⁵ Grosseteste, *Commentarius in Posteriorum analyticorum*, 156–158. Grosseteste does not refer to *APo.* I 3 and the cognition of terms as the epistemic operation of recognizing axioms. Nevertheless Marrone identifies this process with the cognition of universal terms. Axioms are *per se nota* insofar they reveal their own truth. See Marrone (1986), 485 and Rossi (1995), 61–68.

point in another direction and resembles, metaphorically speaking, an equation with at least one unknown quantity. He only accounts for the epistemic operation one has to undergo in order to know these kinds of principles. He neither specifies the kind of principle one is apprehending nor the epistemic state. This, as one could conclude from his final sentence, is experiment. The whole procedure does not seem to be another stage of knowledge—complex or more universal—but rather a completely different cognitive operation with a new outcome. One could translate this operation as being some kind of verification (*probatio*) *ad sensum*, i.e. a kind of test. Furthermore this kind of procedure is described as induction. This first conclusion leaves an empty place which can be filled by again reverting to Robert Grosseteste's commentary on *APo*.

In his commentary on Chapter 18, Book I of *APo*., Robert Grosseteste comments on the relation between knowledge and sense-perception. In this context he develops his theory of the apprehension of the so-called *universale incomplexum* and the *principium universale experimentale*, a principle which shows universal causal connections of natural phenomena.⁵⁶ As Steven P. Marrone has pointed out frequently, this involves a two-stage process. In forming the *universale complexum experimentale* the mind can rely upon the simple universals that have already been grasped. This first step is described by him both as abstraction and induction. *Ratio* starts from sense-perception, from which it abstracts and induces the simple universal, the *universale incomplexum*.⁵⁷ The

⁵⁶ Grosseteste, *Commentarius in Posteriorum analyticorum*, 212–216. There has been a lot of discussion about an adequate interpretation of the *universale complexum experimentale* and its methodological implications in regard to experiment and empirical science in a modern sense. In Eileen F. Serene's objections against A.C. Crombie's interpretation it is an important aspect for her that "[Aristotle's] main point is to show how knowledge comes from sense perception, and since the example [Avicenna's scammony example] is not original to Grosseteste, we must at least question how seriously he takes its interesting features." Serene (1979), 109; Crombie (1953), 61–90. For an overview of Crombie's and Serene's controversy see Marrone (1986, 487) who in his study concludes that one can identify in Grosseteste some kind of test, "and the test was what we would call an experiment", and that the *universalia complexa experimentalia* are principles of natural science. See also, Marrone (1983), 273–279.

⁵⁷ "Ratio vero expergefacta dividit colorem a magnitudine et figuram a corpore et iterum figuram et magnitudinem a corporis substantia, et ita per divisionem et abstractionem pervenit in cognitionem corporis substantie deferentis magnitudinem et figuram et colorem. Verumtamen non novit ratio hoc esse actu universale nisi postquam a multis singulis hanc fecerit abstractionem et occurrerit ei unum et idem secundum

second step, the actual grasping of the *universale complexum*, which is an apprehension of natural laws, consists of an inductive and an experimental element. The “testing” aspect belongs to the stage of experiment where the provisory proposition gained by induction has to undergo an experiment. Of course, in this case, Grosseteste’s source is not the Aristotelian *empeiria*, rather Avicenna and perhaps other Arabic authors.⁵⁸

(T9) *Cum enim sensus apprehendit duo sensibilia pluries quorum alterum alteri est causa vel alio modo ad ipsum comparatum et ipsam comparisonem mediam non apprehendit, utpote cum videt quis frequenter comestionem scammonee et comitantem egestionem cholere rubeae et non videt quod scammonaea attrahit et educit rubeam choleram, ex frequenti visione horum duorum visibilium incipit estimare tertium invisibile, scilicet, quod scammonaea est causa educendi choleram rubeam.*

Et ex hac intentione estimata frequenter et in memoria reposita et ex intentionibus sensatis a quibus accipitur intentio estimata, expurgiscitur ratio, que expergefata incipit admirari et considerare an res se habet sicut dicit estimatio memorata. Et hec duo convertunt rationem ad experientiam, scilicet ut det comedere scammoneam cum circumscriptione et ablatione aliarum causarum purgantium choleram rubeam. Cum autem dederit frequenter scammoneam cum certa circumscriptione et ablatione aliarum causarum educentium choleram rubeam, formatur apud rationem hoc universale quod omnis scammonaea educit secundum se choleram rubeam. Et hec est via qua pervenitur a sensu in principium universale experimentale.⁵⁹

Robert Grosseteste describes three stages in regard to the epistemic objects of this process. It requires at least two *sensibilia*, as a first result an *intentio estimata* and, as an end, the *principium universale experimentale*, the natural law. As epistemic operations we find sense-perception, estimation (a certain formation of a notion), *admiratio* and formation. The first sub-stage still resembles the Aristotelian notion of induction. However, at the end of this inductive process we find a preliminary and fallible proposition which requires further certification. Grosseteste says that the mind awakes via a prior perceptive and estimative process. It starts to wonder (*admirari*) whether the *estimatio memorata*—the *inten-*

iudicium suum in multis singularibus repertum. Hec est igitur via qua venatur universale incomplexum a singularibus per sensus adminiculum.” Grosseteste, *Commentarius in Posteriorum analyticorum*, 214.

⁵⁸ Following A.I. Sabra Jeremiah Hackett points out that the new concept of experience and experiment as a practical test in astronomy was Alhazen’s (Ibn al-Haytham) contribution. See Hackett (1998), 108 f.

⁵⁹ Grosseteste, *Commentarius in Posteriorum analyticorum*, 214 f. For a more detailed explanation of this passage see Marrone (1983), 272–279.

tio estimata stored in memory—is true. In this second sub-stage, the preliminary proposition, the *estimatio memorata*, has to undergo an intra-mental experiment: a verification or *probatio*, as Bacon would put it, takes place. Insofar, Roger Bacon's *inductio ad sensum* might indeed refer to Grosseteste's representation of the Avicennian theory of the five inner senses (*sensus de foris* vs. *sensus interiores ut sensus communis, fantasia vel imaginatio*) since it corresponds perfectly to the *intentio estimata* and *memorata*.⁶⁰ Another important piece of evidence supporting that Roger's source for the *inductio ad sensum* was definitely Grosseteste's commentary, is (as given above) the third acquired principle of science: *admiratio*—in English: amazement or wondering whether something is the case as it appears to be.

(T10) *QUERITUR de admiratione que est principium scientie. Et queritur quid sit et quot exiguntur. Et videtur quod cognitio effectus cum ignorantia cause. [...] Quare duo exiguntur. Cognitio effectus et ignorantia cause. [...] SOLUTIO: cognitio effectus cum ignorantia cause sufficit ad admirationem uno modo, non secundum quod ignoratur causa et cognoscitur effectus absolute, set per collationem ad causam ejus et considerationem. Et in illa consideratio involvitur dubitatio, et tunc est admiratio. Admiratio est cognitio effectus cum ignorantia cause et dubitatione ipsius; dubitatur tunc intellectus ad cognitionem cause.*⁶¹

Although in *Met.* I 2 (982b11–19) we find the similar motive of amazement, curiosity and questioning (*thaumazein, mirari*) as the beginning of philosophy, the *admiratio* Bacon refers to in this context is a mental state which systematically belongs to Grosseteste's second sub-stage of the formation of the *principium universale experimentale* and it is very important since admiration marks the initial point of doubting and verifying the assumption (*intentio estimata*). When the soul perceives a natural phenomenon, an effect, and does not immediately recognise the cause, as in the case of *sollertia*, it starts to wonder about the cause of the phenomenon. The formation of the *estimatio*—Roger actually refers to this as *consideratio*—involves doubt, and evokes (*exigere*) wondering about the unknown cause, and the process sketched above of *inductio et probatio ad sensum* gets going: “*Possumus loqui de cognitione principiorum prout sunt*

⁶⁰ Bacon, *Questiones in libros IV Prime Philosophie*, 14. Avicenna's inner senses are besides the above mentioned the *vis cogitativa*, *vis aestimativa*, and *vis memorialis*. See Avicenna latinus, *Liber de anima seu Sextus de naturalibus* IV–V, ed. Van Riet (1968), IV 1–3, 1–54; especially 34–54 and Wolfson (1935), 69–133.

⁶¹ Bacon, *Questiones supra libros Prime Philosophie*, 11.

in inveniando, et sic experimento cognoscuntur."⁶² Although Roger's presentation is very short one can nevertheless conclude that Grosseteste's explanations provided a model for Roger's account of the apprehension of principles and that accordingly the principles Roger is referring to in this case belong to natural science and are in fact insights into natural causal connections.

3. THE ROLE OF INTELLECT

In regard to the third protagonist in Aristotle's final chapter, insight or intellect, and the second question about the state (*hexis*) that becomes familiar with these principles, Bacon still owes us an answer. In the following he asks twice about the number and sufficiency of the mental states. But, although his remarks about the intellect are very short, they are also very instructive and are coherent with his prior remarks on the apprehension of principles.

(T11) *Quoniam facta est mentio de habitibus anime, ideo QUERITUR numerus et sufficientia habituum anime, et potest sic sumi. [...] Sit sit cum assertionem circa necessitatem; hoc est tripliciter. Aut est habitus circa principia, et hoc dupliciter; aut est habitus in inveniendo ea, et sic experimentum; aut est habitus postquam inventa sunt, et sic est intellectus; aut circa conclusiones tantum, et sic est scientia que est habitus conclusionis.*⁶³

*QUERITUR de numero habituum anime. Sic: aut est habitus anime intellectualis [...] cause tantum aut causati. Et hec dupliciter; aut habitus incompletus, et sic admiratio; aut completus, et sic scientia. Si sit cause, hoc est dupliciter; aut est habilitas et dispositio ad inveniendum medium, et sic est sollertia; aut est habitus derelictus et sic experimentum; aut est habitus derelictus ex experimento, et sic est intellectus habitus principiorum.*⁶⁴

Concerning the states of the intellectual soul, Roger Bacon seems to have felt the need of enlarging the number of states up to fifteen: one state did not seem to be sufficient to him. For example, different objects belong to different times (*preterita, presentia et futura*) and therefore require different mental states.

Noticeable is his choice of criteria: in one instance the criterion concerns principles, in another the criterion is established by knowledge of effects and causes. In both cases his answers in regard to the intellect are

⁶² Bacon, *Questiones supra libros Prime Philosophie*, 11.

⁶³ Bacon, *Questiones supra libros Prime Philosophie*, 14.

⁶⁴ *Ibid.*, 19.

unambiguous. *Intellectus* is no epistemic operation or intellectual process. The multi-staged process of induction which is indispensable for the apprehension of principles is accomplished by the senses and experiment alone. Obviously intellect is not related to the process of induction but is defined as a state of the intellectual soul which is achieved after the principles have been found by experiment. Intellect is a result of the inductive-experimental process in which we discover causes, it is a remnant of experiment, which is the state having to do with the finding of causes and could literally be understood as a possession (*habitus*) of certain principles. This interpretation of course implies a subtle shift in regard to Aristotle's position.⁶⁵

4. CONCLUSION

I hope to have shown that Roger Bacon in his comments on *Met.* I 1 is doing more than just putting side by side the "genetic epistemology" from *APo.* II 19 with the one from *Met.* I 1. In presenting the principles of knowledge, of science and of a certain knowledge about natural causal connections—*sensus*, *memoria*, *experimentum*, *admiratio* and *universale*—he is not only integrating Aristotelian topics from II 19 but also from other chapters of *APo.* He knows about Aristotle's affirmative remarks on the necessary existence of an immediate principle of science from I 3. We also find Aristotle's remarks on the role of the senses from I 18 to be of major importance. In Roger's notion of human cognition the senses account for the very possibility of gaining knowledge. Without sense-perception no knowledge is possible at all. Not only because the human soul in its *sopor* has to be awakened by actual perceptions and the human soul has to gain merit by gaining knowledge, but also because only in singulars does the human soul find the universals which are constitutive for science. Nevertheless one can identify a certain reservation

⁶⁵ *APo.* II 19, 100b14–15 (tr. Barnes 1975): "[...] so if we have no other true kind apart from understanding, comprehension [*nous*] will be the principle of understanding [*epistêmê*]." Detel (1993) vol. 2, 833–836, 873–888 describes the fourth stage of the genetic epistemology, insight, as the state one finds himself in, when apprehending principles insofar they are immediate universal propositions. In his understanding *nous* is the epistemic state in which we, referring to elementary inductions, perform a complex induction, a further fixation and determination of the first primitive universal gained by perception and experience towards a more complex and abstract universal. Nevertheless induction, as an epistemic operation which bears various degrees of complexity, belongs to the third (experience) as well as this fourth stage of the genetic epistemology.

towards the senses and memory since they are not "*causa principalis*" but rather "*causa dispositionis et occasio necessaria et preparatoria*" for the apprehension of principles.⁶⁶ To my understanding this *caveat* serves the purpose of making special room for experiment in the process of the apprehension of principles. Sense-perception is only the first step in a more complex process in which Bacon thoroughly distinguishes between quick-wit—a kind of intuitive cognition by which we recognize axioms—and the experimental cognition of the *principium universale experimentale*.

In describing this process, i.e. human intellectual learning and the apprehension of immediate principles of demonstration, Roger adopts the main elements of Aristotle's doctrine and one specific element of Grosseteste's epistemology. He, as well as other medieval commentators, reads Aristotle in his final chapter of *APo.* as accounting not only for the apprehension of indemonstrable and universal propositions, but also for the apprehension of principles as premises of demonstration. The problem of the first step in the apprehension of principles—the formation of first rudimentary universal terms or concepts—is of minor interest for him. It is treated by him in a semantic-ontological perspective and systematically belongs to the question about the status of universal terms and their reference to universal forms in individual things.

Accordingly, he shifts from the discussion of the principles of any learning to the discussion of principles insofar as they are universal propositions. All of these simple and complex principles—terms, axioms and the *principium universale experimentale*—are recognized by *experimentum* alias *acceptio pluribus singularibus universale in omnibus* or by experiment as knowledge of many facts of the same kind, intra-mentally confronted with the *estimatio memorata*. As a result we find experiment to be the crucial stage in regard to the apprehension of principles. Intellect appears as the state in which we have insight into principles—not during the process of induction, but afterwards. This conception makes sense insofar as experiment and induction alone guarantee the possibility and the certitude of the apprehension of principles.

⁶⁶ Bacon, *Questiones supra libros Prime Philosophie*, 8f.

Roger's interpretation of *nous* and induction has its major and more interesting implications in regard to his understanding of the role of experiment. Apparently it was more important to him to introduce this kind of innovative understanding of experiment than to present the whole picture of *APo.* II 19. What is obvious is his enthusiasm for the idea of experiment as he might have found it in Grosseteste as well as in Alhazen. Twenty years later, the idea of test and verification by experimental knowledge led him to the conception of a *Scientia experimentalis*, euphorically introduced as *domina scientiarum* "*quia sine experientia nihil sufficienter scire potest.*"⁶⁷

⁶⁷ Roger Bacon, *Opus maius*, Vol. III., ed. Bridges (1964), 167.

PART II

METAPHYSICS AS A SCIENCE

ALEXANDER OF APHRODISIAS ON THE SCIENCE OF ONTOLOGY

MADDALENA BONELLI*

1. INTRODUCTION

At the beginning of *Metaphysics* IV, Aristotle asserts that there is a science which considers (θεωρεῖ) being *qua* being and the things that hold of it in its own right.¹ In his commentary on these lines Alexander offers a peculiar characterisation of this θεωρία. He says:

(T1) “First of all, Aristotle holds that there is a science of being *qua* being, namely a science which considers (θεωρητικήν) being *qua* being, and which demonstrates (ἀποδεικτικήν) its ὑπάρχοντα καθ’ αὐτά.”²

The science of being *qua* being, which we today call ‘ontology’, is presented at the beginning of the commentary on *Metaphysics* IV as ἀποδεικτική, demonstrative. Alexander presents this claim as though it were perfectly ordinary. Nowhere does he mention that Aristotle never characterises the science of being *qua* being in this way.³ He does not say that he is himself responsible for the ‘strong’ scientific model of ontology, and it is quite possible that everyone accepted this conception in Alexander’s time.⁴ However, Alexander’s attitude seems to me to be due also to the fact

* The subject of this article was the object of my doctoral research, which has resulted in the publication of a book (Bonelli, 2001a) and an article (Bonelli, 2001b). I am very grateful to Otto Bruun for his help with the English translation of this paper. I am very grateful to Otto Bruun, Giulia Lombardi and Elena Gobbo for their philosophical help.

¹ Arist.*Met.* IV 1, 1003a21–22 (ed. Jaeger, 1957): ἔστιν ἐπιστήμη τις ἣ θεωρεῖ τὸ ὄν ἢ ὄν καὶ τὰ τούτῳ ὑπάρχοντα καθ’ αὐτό.

² Alex., *In Met.*, 239, 6–8 (ed. Hayduck, 1891): Λαμβάνει πρῶτον μὲν τὸ εἶναι τινα ἐπιστήμην περὶ τὸ ὄν ἢ ὄν, τουτέστι τοῦ ὄντος ἢ ὄν θεωρητικήν τε καὶ ἀποδεικτικήν τῶν τούτῳ καθ’ αὐτὰ ὑπαρχόντων.

³ Actually, Aristotle seems to appeal to the demonstrative model for philosophy in *Metaphysics* III, in the part concerned with the *aporiai* on the axioms (*Met.* III 1, 995b6–10; *Met.* III 2, 996b26–997a11), on the substances (*Met.* III 1, 995b10–13; *Met.* III 2, 997a15–25), on the συμβεβηκότα κατ’ αὐτά of substances (*Met.* III 1, 995b18–25; *Met.* III 2, 997a25–34). But such a model is appealed to only to show the *aporiai* which are raised if we apply it to philosophy.

⁴ Note that Aspasius, a commentator writing just before Alexander, and whose work

that 'ontology' is presented by Aristotle as a science, and that, for Alexander it is, as such, necessarily demonstrative. For, in the lines following the beginning of the commentary we have just cited, Alexander asserts that the science of any object demonstrates its *ὑπάρχοντα καθ' αὐτά*.⁵

But how are we to conceive of the science of being *qua* being as a demonstrative science? In the following pages I shall try to answer this question by showing that Alexander applied the scientific method codified by Aristotle in the *Posterior Analytics* to the science of being *qua* being.

2. THE APPLICATION OF THE ARISTOTELIAN SCIENTIFIC MODEL TO THE SCIENCE OF BEING *QUA* BEING

Aristotle presents his conception of demonstrative science in the *Posterior Analytics*. In *APo.* I 7, he mentions three elements which together constitute demonstration: first, the demonstrated conclusion, or that which 'holds' *καθ' αὐτό* (so 'the conclusion' is in fact the *predicate* of the conclusion), secondly the axioms; and thirdly the underlying kind (τὸ γένος τὸ ὑποκείμενον), of which the *πάθη* (viz. the *καθ' αὐτά* συμβεβηκότα), hold *καθ' αὐτά*.⁶ Each demonstrative science, Aristotle goes on to claim, must have a kind, axioms from which we demonstrate, and *πάθη*.⁷

he was familiar with, asserts in his commentary on the *Nicomachean Ethics* that philosophy is a science, and one which makes use of demonstration (Aspasius *In EN* 37.13 and 37.20–22; ed. Heylbut, 1889).

⁵ Alex., *In Met.* 239.8–9: *πᾶσα γὰρ ἡ οὐτινοοσὺν ἐπιστήμη τῶν ἐκείνῳ καθ' αὐτὰ ὑπαρχόντων ἐστὶν ἀποδεικτική*. For the characterisation of philosophy as a science in the 'strong' sense, see also Alex., *In Met.* 7.17–26. Here, Alexander, who is explaining what Aristotle says concerning *sophia* as a science of the first causes and the principles, says that science is *ἕξις ἀποδεικτική*.

⁶ Arist., *APo.* I 7, 75a39–b2 (ed. Ross, 1894): *τρία γὰρ ἐστὶ τὰ ἐν ταῖς ἀποδείξεσιν, ἓν μὲν τὸ ἀποδεικνύμενον, τὸ συμπέρασμα (τοῦτο δ' ἐστὶ τὸ ὑπάρχον γένει τινὶ καθ' αὐτό), ἓν δὲ τὰ ἐξιώματα (ἀξιώματα δ' ἐστὶν ἕξ ὧν)· τρίτον τὸ γένος τὸ ὑποκείμενον, οὗ τὰ πάθη καὶ τὰ καθ' αὐτὰ συμβεβηκότα δηλοῖ ἡ ἀπόδειξις*. Cf. also *Met.* III, 997a19–21 (*πᾶσα ἀποδεικτική περὶ τι ὑποκείμενον θεωρεῖ τὰ καθ' αὐτὰ συμβεβηκότα ἐκ τῶν κοινῶν δοξῶν*).

⁷ Arist. *APo.* I 10, 76b11–16: *πᾶσα γὰρ ἀποδεικτική ἐπιστήμη περὶ τρία ἐστὶν, ὅσα τε εἶναι τίθεται (ταῦτα δ' ἐστὶ τὸ γένος, οὗ τῶν καθ' αὐτὰ παθημάτων ἐστὶ θεωρητική), καὶ τὰ κοινὰ λεγόμενα ἀξιώματα, ἕξ ὧν πρῶτων ἀποδείκνυσι, καὶ τρίτον τὰ πάθη*. On the quite problematic characterisation of these three conditions, cf. Mignucci (1975), 137 and Barnes (1993²), 130.

In his commentary on *Metaphysics* III and IV, Alexander tries to show that these essential scientific conditions are also found in philosophy. In the case of III, Alexander seriously considers the application of the scientific model to philosophy as we find it in Aristotle's discussion of the *aporiai* concerning substances, συμβεβηκότα καθ'αυτά of substances, and axioms. He also establishes a close tie between III and IV, by showing that it is in IV that we find the solutions to the above *aporiai*. Then, in the commentary on the first part of IV, Alexander offers a detailed analysis of the kind of philosophy as a science of being *qua* being.

In order to consider closely the three elements essential to a demonstrative philosophical science, I shall look first at the commentary on IV concerning the kind of the philosophical science, and then at parts of the commentary on III and IV concerning the συμβεβηκότα καθ'αυτά and the axioms.

2.1. *The Kind of the Philosophical Science*

Even if Alexander does not give a thoroughly original and developed analysis of 'being *qua* being', we can nevertheless to some degree reconstruct from his remarks an orthodox yet personal conception of the object of the demonstrative philosophical science.

The kind of the philosophical science presented in IV is being *qua* being.⁸ It must nevertheless be said that Aristotle says very little about being *qua* being and rarely mentions it at all in the *Metaphysics*.⁹ In IV, Aristotle asserts that the science of being *qua* being is not the same as any of the so-called partial sciences. For none of the latter examines being *qua* being universally, but they all select some part of it and study what is incidental concerning that part, as do for instance the mathematical sciences.¹⁰ In VI, he explains in a slightly more detailed manner that the partial sciences deal with a certain being—that is to say, a certain kind (περὶ ὃν τι καὶ γένος τι)—concerning which they demonstrate the

⁸ We are reminded of the beginning of Arist. *Met.* IV, 1003a21–22: "Ἔστιν ἐπιστήμη τις ἣ θεωρεῖ τὸ ὄν ἢ ὃν καὶ τὰ τοῦτω ὑπάρχοντα καθ' αὐτό.

⁹ For being *qua* being is treated only at the beginning of the books IV (1003a21–1005a18) and VI (1025a3–1026a32). There are also remarks in this regard in XI, but the book is possibly spurious, and in any case it is only a summary of the books III, IV and VI, and of a part of the *Physics*.

¹⁰ Arist., *Met.* III 1, 1003a22–26: αὕτη δ' ἐστὶν οὐδεμιᾶ τῶν ἐν μέρει λεγομένων ἡ αὕτη· οὐδεμία γὰρ τῶν ἄλλων ἐπισκοπεῖ καθόλου περὶ τοῦ ὄντος ἢ ὄν, ἀλλὰ μέρος αὐτοῦ τι ἀποτεμώμεναι περὶ τοῦτου θεωροῦσι τὸ συμβεβηκός, οἷον αἱ μαθηματικαὶ τῶν ἐπιστημῶν.

ὑπάρχοντα καθ'αυτά;¹¹ and in this they differ from the science which studies being in the absolute sense (ἀπλῶς) and *qua* being (ἢ ὄν). In these passages, then, Aristotle underlines the characteristics of the object of philosophy, which is universal, whereas those of the other sciences are partial. In the subsequent section of IV, Aristotle goes on to present an analysis of beings (ὄντα).¹²

Alexander accepts the Aristotelian theory according to which objects, qualities, weights, thoughts, and so on, are all ὄντα, beings. However, he also adds some interesting points of his own (all justified by the text of Aristotle he was reading) regarding three aspects, the third of which is of particular interest to me:

- 1) The attribution of an existential sense to 'being' (ὄν);
- 2) The consideration of 'as being' (ἢ ὄν) as a formula which characterises the way philosophy considers the ὑπάρχοντα καθ'αυτά of the ὄν;
- 3) The possibility of considering being as a quasi-kind.

2.1.1. ὄν as ὑπαρξίς

The first point concerns the sense we should accord to the term ὄν. Alexander adheres to a thesis which attributes an existential sense to ὄν.¹³

In his commentary on the *Prior Analytics*, Alexander asserts that a sentence like "Socrates is" (Σωκράτης ἔστι), which must of course mean "Socrates exists", is equivalent to "Socrates is being" (Σωκράτης ὄν ἔστιν); here ὄν, which, as Alexander notes, is the predicate term, must have an existential sense, so that the sentence will be equivalent to "Socrates is existent".¹⁴

A yet more important passage is found in the commentary on IV, where Alexander explains ὄν in terms of ὑπαρξίς. The commentator is here considering the passage where Aristotle, after having presented his analysis of being, invokes a sort of mutual implication between 'one'

¹¹ Arist., *Met.* VI 1, 1025b7–13.

¹² Arist., *Met.* IV 2, 1003a33–1003b10. This is the famous analysis of being as πολλὰ-χῶς λεγόμενον πρὸς ἓν, according to which all things are said to be ὄντα, but in relation to substance, which is called ὄν in the proper sense.

¹³ This point seems to me very important, above all if we keep in mind the whole current dispute on the sense one should give to the Aristotelian τὸ ὄν ἢ ὄν. For a quick overview of the positions on this question see Bonelli (2001a), 88–89.

¹⁴ Alex *In Apr.* 15.17–19: ἡ γὰρ λέγουσα πρότασις "Σωκράτης ἔστιν" ἴσον δύναται τῇ "Σωκράτης ὄν ἔστιν", ἐν ᾗ γίνεται τὸ ὄν μετὰ τοῦ "ἔστιν" ὁ κατηγορούμενος ὅρος, οὐ τὸ "ἔστιν".

and ‘being’, which serves to justify the fact that ‘one’ and ‘being’ have to be studied by the same science, namely philosophy.¹⁵ Our commentator explains the differences between ‘one’ and ‘being’ in the following way:

(T2) We predicate being and one according to different concepts: when we say that something is being, we signify its ὑπαρξις, whereas when we say that something is one, we signify its separation from the other things and from multiplicity.¹⁶

The translation of ὑπαρξις as ‘existence’ is mandatory in the case of another passage of the commentary on the *Metaphysics*, this time on *Delta*, in the part which deals with the Aristotelian analysis of εἶναι καθ’αυτό. In this part of *Delta*, Aristotle presents a theory according to which

(T3) “those things are said to be in their own right that are indicated by the figures of predication. For the senses of ‘being’ are just as many as these figures.”¹⁷

Εἶναι καθ’αυτό then has just as many senses as there are categories. In the relevant commentary, Alexander presents a theory of the homonymy of being in terms of the ὑπαρξις appropriate to each thing, according to the categories. When I pronounce a sentence like “Socrates is”, I am speaking of the substantial ὑπαρξις of Socrates, whereas if I utter a sentence such as “this colour is”, then—so Alexander says—I am speaking of the ὑπαρξις peculiar to quality, and so on.¹⁸ But Alexander completes this theory by claiming that in the case of sentences of the subject-predicate form, the copula expresses ὑπαρξις, namely ὑπαρξις of the predicate. For example, a sentence such as ἄνθρωπος ὑγιαίνων ἐστίν means the same as ἄνθρωπος ὑγιάει, and in it the copula ‘ἐστίν’ signifies the ὑπαρξις of health.¹⁹ What Alexander says here seems somewhat forced. But whether

¹⁵ Arist., *Met.* IV 2, 1003b22–25.

¹⁶ Alex., *In Met.* 247.18–20: κατὰ διάφορον δὲ ἐπίνοιαν τό τε ὄν καὶ τὸ ἐν κατηγοροῦμεν, διὰ μὲν τοῦ ὄν εἰπεῖν τι τὴν ὑπαρξιν σημαίνοντες αὐτοῦ, διὰ δὲ τοῦ ἐν τὸν ἀπὸ τῶν ἄλλων χωρισμὸν καὶ τὸν ἀπὸ τοῦ πλήθους.

¹⁷ Arist., *Met.* V 7, 1017a22–24: καθ’ αὐτὰ δὲ εἶναι λέγεται ὅσα περ σημαίνει τὰ σχήματα τῆς κατηγορίας· ὅσα χῶς γὰρ λέγεται, τοσαυταχῶς τὸ εἶναι σημαίνει. The reduction of the homonymy of being to the categories is also found in *Met.* VII 1, 1028a10–13.

¹⁸ Alex., *In Met.* 371.22–26: τὴν γὰρ οἰκείαν ὑπαρξιν ἐκάστου σημαίνει τὸ ὄν ὁμώνυμον· εἰ δὲ δέκα αἱ κατὰ τὰ ἀνωτάτω γένη διαφοραί, δεκαχῶς καὶ τὸ ὄν τε καὶ τὸ εἶναι ῥηθήσεται. τὸ μὲν γὰρ τῇ οὐσίᾳ συντασσόμενον εἶναι τὴν οὐσιώδη ὑπαρξιν σημαίνει, τὸ δὲ τῷ ποσῷ τὴν ὡς ποσοῦ, καὶ τῷ ποιῷ τὴν ὡς ποιοῦ, καὶ ἐπὶ τῶν ἄλλων γενῶν ὁμοίως.

¹⁹ Alex. *In Met.* 371.29–33: δεικτικὸν δὲ τοῦ τὸ ἐστίν, ᾧ ἂν συντάσσεται, ἐκείνην σημαίνει τὴν φύσιν, παρέθετο τὸ μηδὲν σημαίνειν ἄλλο τὸ ἄνθρωπος ὑγιαίνων ἐστίν

or not his interpretation is defensible, it is clear that Alexander's theory can make sense only if we translate ὑπαρξις by 'existence'.

According to this theory, in a sentence such as "Socrates is", 'is' expresses the substantial ὑπαρξις of Socrates. In a sentence such as "Socrates is walking" (where this is equivalent to "Socrates walks"), 'is' expresses the ὑπαρξις of the walking in Socrates. Alexander must have in mind the Aristotelian theory of the existential dependence of any accident on the existence of the substance.

2.1.2. 'Qua Existent'

If this interpretation is correct, Alexander holds a theory according to which the object of the science of book IV is all that exists. But in what way does it consider all that exists? To this question we can answer that philosophy considers existing things *qua existing things*, and not, say, *qua* musical or medical things.²⁰ The idea is this: if I consider existing things such as a melody or a drug, I can detect aspects for which these things are studied by two different sciences (music and medicine). Yet I can also consider other aspects, determined by the fact that these things exist, which permit us to group these things in one single class—namely, the class of things which exist, the object of one science: first philosophy. I shall come back to these aspects or properties of existing things. For the moment, I would like to stress the universality of first philosophy. For any given object can be considered 'qua existent'.

2.1.3. *The Kind of Items which Exist*

For ontology to constitute a demonstrative science in accordance with the model of the *Posterior Analytics*, the object of this science—what exists—

ἢ τὸ ἀνθρώπος ὑγιαίνει, τουτέστι τὸ ἔστιν, ὃ ἐπὶ τῇ ὑγείᾳ συντέτακται, μηδὲν ἄλλο ἢ τὴν τῆς ὑγείας ὑπαρξιν σημαίνει. It is difficult to render in English the difference between the participle and the indicative present of the verb ὑγιαίνειν, which means precisely 'to be in good health'.

²⁰ Alex. *In Met.* 244.6–8: καὶ περὶ τοῦ ὄντος δὲ μιᾶς ἐπιστήμης θεωρῆσαι καθὸ ὄν ἔστιν· οὐ γὰρ καθὸ μουσικά ἢ ἰατρικά, ἀλλὰ καθὸ ὄντα καὶ τῆς τοῦ ὄντος κεκοινώνηκε φύσεως ("One single science considers the existent *qua* existent: it does (not consider existents) *qua* musical or medical things, but *qua* existents and things which share the nature of being". Cf. also Arist., *Met.* IV 2, 1004b5–8: ἐπεὶ οὖν τοῦ ἐνὸς ἢ ἐν καὶ τοῦ ὄντος ἢ ὄν ταῦτα καθ' αὐτά ἐστι πάθη, ἀλλ' οὐχ ἢ ἀριθμοὶ ἢ γραμμαὶ ἢ πῦρ, δηλον ὡς ἐκείνης τῆς ἐπιστήμης καὶ τί ἐστι γνωρίσαι καὶ τὰ συμβεβηκότ' αὐτοῖς). It is clear that Alexander uses καθὸ as an equivalent to ἢ; cf. *In Met.* 239, 22–25, which is a paraphrase of Aristotle *Met.* IV 1, 1003a22–24 (αὕτη δ' ἐστὶν οὐδεμία τῶν ἐν μέρει λεγομένων ἢ αὐτή· οὐδεμία γὰρ τῶν ἄλλων ἐπισκοπεῖ καθόλου περὶ τοῦ ὄντος ἢ ὄν).

must constitute a unique kind. But how are we to consider everything that exists as a unique kind, given that Aristotle seems precisely to deny that it constitutes a unique kind?²¹

Alexander accepts Aristotle's theory according to which beings (or items which exist, according to Alexander's interpretation) depend on what exists in the proper sense, viz. substance.²² According to this theory, each thing can be called 'existent' either because it is a substance, or because it is an attribute of a substance, or a change, or generative of a substance, and so on. In this way, the existence of everything that is not a substance is subordinate to the existence of substances.

For his part, Alexander specifies that we call only substance ὄν in the proper sense, but that the συμβεβηκότα of substances, the nine genera, are also ὄντα.²³ In this way, he recognises that the particular homonymy of existence concerns the sort of existence appropriate to each category, as we have seen in his commentary on *Met.* V. The subordination of the existents to substance allows us

- (1) to consider items that exist as a kind, even if it is a kind κοινότερον, 'in the broad sense of the term';
- (2) justify the fact that one single science—i.e. philosophy—is concerned with all the items which exist.

These two points are developed in the commentary on the passage of IV where Aristotle explains the unity of the philosophical science of being *qua* being by saying that "of each single kind there is one single sensation and one single science".²⁴

In his comments on this passage, Alexander explains that here Aristotle uses the term 'kind' in the broad sense (κοινότερον), meaning 'one nature'. He also specifies that the κοινότερον kind is constituted by the things which 'communicate' mutually according to a single nature, among which we find also those that derive their 'existing' from something else.²⁵ According to Alexander, an existing colour, an existing

²¹ Cf. Arist., *Met.* III 3, 998b21–24. But see *Met.* IV 2, 1003b18–22 (see note 24 below).

²² Cf. Arist., *Met.* IV 2, 1003b5–10.

²³ Alex., *In Met.* 242.10–12: ὄν γὰρ λέγεται κυρίως μὲν ἡ οὐσία, λέγεται δέ γε ὄντα καὶ τὰ τῇ οὐσίᾳ συμβεβηκότα, ἃ ἔστι τὰ ἐννέα γένη.

²⁴ Arist., *Met.* IV 2, 1003b19–22: ἅπαντος δὲ γένους καὶ αἰσθησις μία ἐνὸς καὶ ἐπιστήμη, οἷον γραμματικὴ μία οὐσα πάσας θεωρεῖ τὰς φωνάς· διὸ καὶ τοῦ ὄντος ἢ ὄν ὅσα εἶδη θεωρεῖσθαι μᾶς ἐστὶν ἐπιστήμης τῷ γένει, τὰ τε εἶδη τῶν εἰδῶν.

²⁵ Alex., *In Met.* 245.1–5: παντός γάρ φησι γένους ἐνὸς καὶ ἐν τοῖς αἰσθητοῖς αἰσθησιν μίαν εἶναι καὶ ἐν τοῖς ἐπιστητοῖς ἐπιστήμην μίαν, γένους μὲν κοινότερον

weight, and an existing form, have between them a relation subordinated to the fact that their existence depends on the existence of a substance. Alexander has previously spoken of “having a *κοινωνία* according to the same nature” in relation to the *πολλαχῶς λεγόμενα πρὸς ἓν καὶ μίαν φύσιν* (such as healthy things, medical things and, notably, existents).²⁶ In the case of the *ὄντα*, the ‘common nature’ shared by them will be substance, which is the common nature because it is somehow observed in all beings, due to the fact that the existence of every being depends on the existence of substance. It is thanks to this existential dependence that the existents constitute a kind, even if only *κοινότερον*. The broader sense of ‘kind’ lets Alexander include also the *πολλαχῶς λεγόμενα πρὸς μίαν φύσιν* in the class of the objects of a science. A kind in the broad sense can certainly be divided into species, themselves species in the broad sense. This would let us conceive of the science that is concerned with existents as a unit, despite the fact that the existents do not constitute a kind in the strict sense.

In order to clarify this second point, Alexander uses three examples, two of which derive from Aristotle:

- (1) If x (for example, sight) perceives y (for example, white), then x perceives all the objects that communicate the same nature as y (the other colours);²⁷
- (2) If x (for example, grammar), considers y (for example, words with acute accents), then x considers all objects which communicate the same nature as y (all words);²⁸
- (3) If x (the philosopher) considers y (the existent—substance), then x considers all the objects which communicate the nature of y (the other existents).²⁹

λαμβάνων ἀντὶ τοῦ φύσεως μιᾶς· γένη γὰρ κοινότερον πάντα ὅσα κατὰ τινα μίαν φύσιν κεκοινωνήκεν ἀλλήλοις· τοιαῦτα δὲ καὶ τὰ ἀφ’ ἐνός τινος τὸ εἶναι ἔχοντα.

²⁶ Cf. Alex. *In Met.* 241.18–21; 243.18–20; 243.33–244.3.

²⁷ Alex. *In Met.* 245.5–9: καὶ γὰρ ἐν τοῖς αἰσθητοῖς πάντων τῶν τῆς αὐτῆς φύσεως τῶνδε τινι, οὗ ἔστιν ἥδε ἡ αἰσθησις ἀντιληπτική, κεκοινωνηκότων ἡ αὐτὴ αἰσθησις ἀντιλαμβάνεται· οἷον τῶν τῷ λευκῷ ὁμογενῶν πάντων (ταῦτα δὲ ἔστι τὰ χρώματα) ὅψις ἔστιν ἀντιληπτική.

²⁸ Alex. *In Met.* 245.10–12: ὁμοίως πάλιν ἡ γραμματικὴ οὐ τῆσδε τῆς φωνῆς, φέρε εἰπεῖν τῆς ὀξεύας, ἔστι θεωρητικὴ μόνης, ἀλλὰ καὶ πάσης φωνῆς καθὼ φωνή.

²⁹ Alex. *In Met.* 245.12–14: ἐπεὶ τοίνυν καὶ τὸ ὄν μιᾶς φύσεως κεκοινωνήκε καθὼ ὄν (τοιούτον γὰρ ἐδείχθη), οὐ τὸ θεωρεῖν περὶ τῆς οὐσίας, τούτου καὶ περὶ παντός τοῦ ὄντος ἢ ὄν ἔσται τὸ θεωρεῖν.

We could thus conclude that, if philosophy concerns substances, it will concern also all the existents.

Alexander's reasoning (which means only to be explicating Aristotle)³⁰ is not convincing. First of all, despite the use of the same verb—κοινωνεῖν—for the example of colours and for that of existents, the two cases are quite different. Colours communicate the same nature in the sense that they *have* the same nature, such that, if sight perceives whiteness, it can perceive the other colours. However, existents communicate the same nature in the sense that they *depend* on one nature for their existence. And existential dependence, in my opinion, is not enough to show that, if I am involved in the science of substances, then I am involved in the science of all the other existents. We might plausibly say that, if I am concerned with x, and if x is part of the explanation of y, then I am concerned with y, at least implicitly. Nevertheless, this does not entail that anyone involved in the science of x is also involved in the science of y.

At any rate, Alexander's analysis is an attempt to understand and render explicit the possibility of a scientific account of existents. And the problem does not lie in what Alexander says, but rather in the general Aristotelian conception of science as essentially concerned with a unique kind. The sciences, according to Aristotle, are characterised by their underlying kind. But this supposition is problematic and difficult to grasp. It is problematic because it is not clear that a science has a single underlying kind. Consider, for example, geometry, which concerns itself—according to Aristotle—with points, lines, and surfaces. Can we say that geometry involves the demonstration of theorems concerning points, lines, and surfaces? We should rather say that it involves demonstrations concerning figures constructed from the points, the lines and the surfaces.

The supposition is also difficult to grasp because it is not clear what a kind is. Consider for example health (which, for Aristotle, constitutes a scientific example comparable to that of the ὄντα): if we adhere to what Aristotle says, we would say that dietetics, pharmacology, and gymnastics are distinct, but that they all have a relation to medicine (the science of healthy things) because all of them concern matters of health. But how shall we conceive these relations? Should we say that they are distinct sciences, or rather that they are parts of one single science? And what are we to say about the sciences which concern a certain kind of existent

³⁰ Cf. Arist. *Met.* IV 2, 1003b16–19.

(such as zoology, biology, mathematics)? Should we say that they are parts of philosophy which concerns the existent generally? Or rather that they are distinct? Aristotle and Alexander do not seem to have asked themselves such questions.

We could then propose the following solution for ὄντα. It is clear, as we have noted, that the question of the homonymy of existents reduces to the question of the existence of the categories. But rather than considering the categories as a sort of single kind, we could imagine different demonstrative sciences, one for substances, another for qualities, yet another for quantities, and so on, all associated with each other and dependent on the science of substances.³¹

2.2. *The ὑπάρχοντα καθ'αυτά*

After having dealt with being *qua* being,³² Aristotle dedicates a part of IV to the consideration of the one (τὸ ἓν), of multiplicity (τὸ πλῆθος), and of their species (the identical (ταὐτόν), the equal (ἴσον), the similar (ὅμοιον) as regards the one; the different (ἕτερον), the unequal (ἄνισον), the dissimilar (ἀνόμοιον) as regards multiplicity).³³ Even if, in this section, he does not call them ὑπάρχοντα καθ'αυτά, he refers to them in a similar way, that is to say, as πάθη καθ'αυτά and ὑπάρχοντα τῷ ὄντι ἢ ὄν.³⁴

Alexander's main contribution to the analysis of the ὑπάρχοντα καθ'αυτά of being *qua* being is to be found in his commentary on *Met.* III, in the comments on the Aristotelian *aporia* regarding the συμβεβηκότα καθ'αυτά of substances.³⁵ In his formulation of this *aporia*,³⁶ Alexander identifies without difficulty the συμβεβηκότα καθ'αυτά with the ὑπάρχοντα καθ'αυτά, and then goes on to distinguish two sorts of ὑπάρχοντα καθ'αυτά:

- i) Those that fit into the definition of the essence (τὰ ἐν τοῖς ὁρισμοῖς παραλαμβανόμενα), which he calls κυρίως, and
- ii) the συμβεβηκότα καθ'αυτά, which are 'inseparable' (ἀχώριστα), 'proper' (ἴδια) and 'almost of the essence' (ἐγγὺς οὐσιώδη).

³¹ There are passages in Alexander which seem to suggest this solution: see for example *In Met.* 245, 25–35.

³² *Arist., Met.* IV 2, 1003a33–1003b12.

³³ *Arist., Met.* IV 2, 1003b22–1004b8.

³⁴ *Arist., Met.* IV 2, 1004b5–6; 1005a13–14.

³⁵ *Arist., Met.* III 1, 995b18–25.

³⁶ *Alex., In Met.* 176.19–30.

Alexander offers four examples of this last sort of *ὑπάρχοντα καθ'αυτά*:

- 1) having the three angles equal to two right angles in the case of triangles;
- 2) having two sides greater than the third side in the case of triangles;
- 3) being even or odd for numbers;
- 4) being one for each being insofar as it is a *tode ti* ("this so-and-so", something determinate).³⁷

These *ὑπάρχοντα καθ'αυτά* are necessary, non-definitional properties.

Alexander here presents a theory according to which a 'scientific' object is 'definable' not only in terms of definitional properties, but also in terms of a description³⁸ of properties which hold of it in virtue of themselves (in other words—necessarily), although they are not part of its essence. It is nevertheless clear that, according to Alexander, the *ὑπάρχοντα* also comprise the *συμβεβηκότα καθ'αυτά*, that is to say the demonstrable properties, as the first example (having the three angles equal to two right angles in the case of triangles) indicates.³⁹

In the case of the first type of *ὑπάρχοντα καθ'αυτά* Alexander has in mind the first sort of *ὑπάρχον καθ'αυτό* found in *APo.* I 4. According to Aristotle, something holds *καθ'αυτό* of something else when the first is part of the latter's essence.⁴⁰ Put more precisely:

- (i*) A holds of B *καθ'αυτό* =_{df} A holds of B, and A inheres in the definition of B.⁴¹

Aristotle provides as examples the line holding of the triangle and the point holding of the line: The explanation seems to be that the definition of the triangle is constructed from the line and that of the line from the point.

With the second definition, Alexander is thinking of the second sort of *ὑπάρχοντα καθ'αυτά* of the *Posterior Analytics*, since one of the

³⁷ Alex., *In Met.* 176.29–30.

³⁸ The term is *ὑπογραφή* (176.25), and refers to the distinction, already familiar to the stoics, between this term and *ὁρισμός*, in order to indicate the difference between definition proper and a general description.

³⁹ A common example in Aristotle (cf. Bonitz (1870), 770). In *Metaphysics* V Aristotle defines the *συμβεβηκότα καθ'αυτά* as 'the things which belong *καθ'αυτό* to each thing while not being in its essence' (Arist., *Met.* V 30, 1025a30–34); they are identified by Aristotle as the demonstrable (Arist. *APo.* I 7, 75a42–b2). On "having the three angles equal to two right angles for the triangle" as a proof, see Alex. *In Apr.* 12.32–13.4.

⁴⁰ Arist. *APo.* I 4, 73a34–37.

⁴¹ Barnes (1993), 112.

examples Alexander gives—“being even or odd for numbers”—is precisely used by Aristotle to illustrate his second sense. Aristotle’s Greek is not easy, but we can extract the following definition:

- (ii*) A holds of B καθ’αυτό =_{df} A holds of B and B inheres in the definition of A.⁴²

Among the examples Aristotle provides we find “even and odd for number”: Number is included in the definition of even and odd.⁴³ Later, Aristotle makes it clear that only these two senses of ὑπάρχειν καθ’αυτό are relevant to demonstration.⁴⁴

It seems that the Aristotelian distinction coincides with the distinction that Alexander makes in his commentary on *Met.* III. In the first case (definitions (i) et (i*)), this is obvious: we are dealing with ὑπάρχοντα καθ’αυτά κυρίως. As regards the second distinction ((ii) et (ii*)), it is more difficult, but as we have already remarked, Alexander presents the example of even and odd numbers, which is exactly one of the examples given by Aristotle for the second sort of ὑπάρχειν καθ’αυτό.

At this point it is important to stress that, among the examples of the second sort of ὑπάρχειν καθ’αυτό given by Alexander, there is one which belongs to the philosophical science of *Metaphysics* IV: being one, which holds καθ’αυτό of the existent. Being one, then, is clearly identified by Alexander as an essential yet non-definitional attribute of the existent.

The other ὑπάρχοντα καθ’αυτά of existents (identical/different, similar/dissimilar, etc.) also fit easily into the framework of essential non-definitional attributes of the existent. In a passage of the commentary on IV, Alexander explains that identical, similar, and equal are species of the one (in other words, they are definable in terms of the one). And the same goes for the species of multiplicity (which are definable in terms of multiplicity, and which are themselves also objects of philosophy because contraries are dealt with by one and the same science).⁴⁵ Alexander introduces these ὑπάρχοντα καθ’αυτά in the commentary on III, just after the presentation of the aporia concerning the συμβεβηκότα καθ’αυτά

⁴² Barnes (1993), 112.

⁴³ Note that these two uses of ὑπάρχειν καθ’αυτά were familiar to Alexander; see Moraux (1979), 17–18 and 56–57.

⁴⁴ Arist. *APo.* I 22, 84a11–17. This restriction raises a problem: the definition of the two kinds of ὑπάρχοντα καθ’αυτά seems to imply that only axiomatic principles can be καθ’αυτά; for the two kinds of καθ’αυτά ὑπάρχοντα are, each of them, definitional (the first of B and the second of A). One possible solution to this difficulty is to suppose that the συμβεβηκότα καθ’αυτά are ὑπάρχοντα καθ’αυτά only in a derivative fashion.

⁴⁵ Alex., *In Met.* 250.13–17.

of substances. At this point he makes an important claim: he asserts that Aristotle decides to deal with these properties because Aristotle himself *uses such properties in his own demonstrations* in this treatise (the *Metaphysics*): for example, he applies identity to the οὐσίαι, when he inquires whether they are mutually the same or not.⁴⁶ But in general, Alexander adds, Aristotle uses all these properties, because *they are the tools common to* (i.e. shared by) *those who demonstrate*.⁴⁷ Our commentator does not limit himself to introducing the one as a ὑπάρχον καθ'αυτό of the existent; he claims that the ὑπάρχοντα καθ'αυτά of the existent belongs to philosophy, because they are common to existents, but also because they are tools common to philosophical demonstrations.

In conclusion, Alexander establishes that unity, multiplicity, and their species are non-definitional properties of the existent as existent, which appear as terms in the scientific propositions, some of which are axioms and others theorems. At the end of this article, I shall present philosophical examples of axioms and theorems concerning one of these terms.⁴⁸

2.3. The Axioms of Philosophical Science

In *Metaphysics* III, Aristotle asks the question whether the science of the first principles of substance must also consider the principles “from which everyone demonstrates”.⁴⁹ In IV, he goes on to show that the science of being *qua* being must also consider the common axioms, since its status is different from those of the other sciences. The latter are partial, whereas philosophy is universal since it concerns being *qua* being. Given that the common axioms hold of all beings *qua* being, it follows that philosophy studies them as well.⁵⁰

Alexander goes beyond Aristotle, and tries to show that philosophy not only concerns axioms, but also uses them. This position is made clear when Alexander considers the passage of *Metaphysics* IV where Aristotle presents the difference between dialectic, sophistic, and philosophy.⁵¹

⁴⁶ Alex., *In Met.* 177.2–6: προτίθεται δὲ ζητεῖν καὶ περὶ τούτων, ἐπειδὴ αὐτὸς χρῆται αὐτοῖς ἐν τοῖς ἀποδεικνυμένοις πρὸς αὐτοῦ κατὰ τήνδε τὴν πραγματείαν· καὶ γὰρ τῷ ταύτῳ ὅπερ ἐπ' οὐσιῶν λέγεται χρῆται. ζητεῖ γοῦν εἰ αἱ αὐταὶ εἰσι πᾶσαι αἱ οὐσίαι ἀλλήλαις ἢ οὐ ἀλλ' ἕτεραι.

⁴⁷ Alex., *In Met.* 177.6–8: ἀλλὰ καὶ τοῖς ἄλλοις οἷς κατέλεξε πᾶσιν ἐν ταῖς ἀποδείξεσιν ἀναγκαῖον αὐτῷ προσχρῆσθαι κοινὰ γὰρ ταῦτα ὄργανα τοῖς ἀποδεικνύουσι.

⁴⁸ See p. 116 ff. below.

⁴⁹ Arist., *Met.* III 1, 995b6–10. Cf. also III 2, 996b26–31.

⁵⁰ Arist., *Met.* IV 3, 1005a19–23.

⁵¹ Arist., *Met.* IV 2, 1004b17–26.

When he looks at the relation between philosophy and dialectic, Alexander remarks that the two deal with existents and their *ὑπάρχοντα*, and that both use syllogisms, but that philosophy has a syllogistic capacity which is based on true things, whereas dialectic syllogizes on the basis of *ἐνδοξα*.⁵² Alexander does not mention axioms, but he clearly has them in mind and thinks of them as demonstrative truths.⁵³ So he holds that philosophy is a science which uses axioms for its demonstrations.⁵⁴ But what axioms does it make use of? Aristotle thought that the science of being *qua* being must concern itself with the principles which in the *Posterior Analytics* are called *common* and which are distinguished from the principles peculiar to each science,⁵⁵ for example (1) the principle of non-contradiction, and (2) the principle of the excluded middle.⁵⁶ In the commentary on III⁵⁷ and IV,⁵⁸ Alexander, with the *Posterior Analytics* in mind, mentions the same examples of common axioms, but adds also two axioms concerning quantity:

- 3) 'Things equal to the same thing are equal to each other' (τὸ τὰ τῷ αὐτῷ ἴσα καὶ ἀλλήλοις εἶναι ἴσα);
- 4) 'If equals are subtracted from equals the remainders are equal' (καὶ τὸ ἂν ἀπὸ ἴσων ἴσα ἀφαιρεθῇ, καὶ τὰ καταλειπόμενα ἴσα εἶναι).

It is important to note that the two axioms concerning quantity—the second of which is presented as a common axiom in the *Posterior Analytics*⁵⁹—also appear in Euclid's geometry.⁶⁰ Here we have two axioms

⁵² Alex., *In Met.* 260.1–5: τὴν φιλοσοφίαν λέγει τῆς μὲν διαλεκτικῆς διαφέρειν τῷ τρόπῳ τῆς δυνάμεως. ἀμφοτέραι μὲν γὰρ περὶ τὸ ὄν καὶ τὰ τοῦτο ὑπάρχοντα, καὶ ἀμφοτέραι συλλογιστικαί, ἀλλ' ἡ μὲν τὴν δύναμιν ταύτην τὴν συλλογιστικὴν ἀποδεικτικὴν ἔχει τῶν ἀληθῶν, ἡ δὲ διαλεκτικὴ πειραστικὴ περὶ τῶν ἀληθῶν καὶ τοῦ ἐνδόξου συλλογιστικῇ.

⁵³ See also Alex., *In Met.* 260.22–26.

⁵⁴ He reiterates this observation several times: see for example *In Met.* 187.30–31; 187.34; 188.1–2.

⁵⁵ Arist., *APo.* I 7, I 9, I 10.

⁵⁶ Arist., *Met.* III 1, 995b6–10; III 2, 996b27–30.

⁵⁷ Alex., *In Met.* 175.10–13.

⁵⁸ Alex., *In Met.* 264.35–265.3: ἔστι δὲ τὰ ἀξιώματα ἀρχαὶ κοινὰ καὶ ἀναπόδεικτοι πρὸς τὰ κατὰ πάσας τὰς ἐπιστήμας δεικνύμενα χρήσιμοι, οἷον τὸ ἐπὶ παντός τὴν κατάρφασιν ἢ τὴν ἀπόφασιν, καὶ τὸ τὰ τῷ αὐτῷ ἴσα καὶ ἀλλήλοις ἴσα, καὶ ἐὰν ἀπὸ ἴσων ἴσα ἀφαιρεθῇ, καὶ τὰ καταλειπόμενα ἴσα, καὶ τὰ τοῦτοις ὅμοια.

⁵⁹ Arist., *APo.* I 10, 76a41; I 11, 77a30–31.

⁶⁰ The relation between the theory of science in the *Posterior Analytics* and the axiomatic system of Euclid has been much discussed. Here it suffices to keep in mind that Alexander was familiar with Euclid's work, and that the argument of transitivity, based on

where the term 'equal' (ἴσον)—which is one of the ὑπάρχοντα καθ'αυτὰ of existents—appears. Naturally, this raises the problem of the sense in which the latter axioms are common to all sciences, because they concern only quantity. One plausible solution consists in preferring a weaker version, according to which certain axioms are common, not to all sciences, but to more than one.⁶¹ This is perhaps what Alexander is headed for when he characterizes the principle of non-contradiction as 'the principle which is the most common of all', since "it is true of all things".⁶²

In the commentary on *Metaphysics* IV, Alexander also offers an explanation of the application of the common axioms to all existents. He explains that the sciences use these axioms since they are concerned precisely with the existents. For axioms belong to things insofar as things are existents, since 'existent' is what is common to them.⁶³ We have seen that Alexander seems to interpret the application of the common axioms in terms of 'being true' of existents.⁶⁴ If this interpretation is correct, our commentator seems to be proposing a theory according to which the common axioms are true of what exists due to the fact that it exists. But at this point we are faced with a problem typical of theories that reduce being to existence: is it true that the axioms hold of things in virtue of the fact that these things exist? The same problem applies to the ὑπάρχοντα καθ'αυτὰ of existents (identical/different, etc.). If, for example, we consider the principle of identity, which is based on the property of 'being identical to ...', and if we accept the theory that I have attributed to Alexander, we will have to say that only the existent things are identical to themselves. In a similar vein, we will have to apply the common axioms, which will be true only for the existents, in such a way that the question arises how to consider the case of things which no longer exist (or which

the axiom 'things equal to the same thing are equal to each other', attributed to Euclid (cf. Alex. *In Apr.* 22.4) is presented by Alexander as a standard inference; cf. Barnes (1990), 7–119.

⁶¹ In Aristotle there is a parallel case concerning the 'common sensibles' (*De anima*, 418a16–20): here Aristotle presents movement as a common sensible, which can be perceived by touch and simultaneously by sight (the remark is taken from Barnes (1993), 99–100).

⁶² Alex., *In Met.* 175.13–14: καὶ κοινότατόν γε τὸ τῆς ἀντιφάσεως ἀπάντων τῶν ἀξιωματικῶν ἀληθὲς γὰρ ἐπὶ πάντων.

⁶³ Alex., *In Met.* 265.24–25: πάντες οὖν διὰ τοῦτο αὐτοῖς χρῶνται, ὅτι καθὸ ὄντα ἐστὶ περὶ ἃ πραγματεύονται, κατὰ τοῦτο αὐτοῖς ὑπάρχει· πᾶσι γὰρ αὐτοῖς τὸ ὄν κοινόν.

⁶⁴ See note 61 above.

do not yet exist), and the pure non-entities.⁶⁵ One solution would consist in broadening the notion of existent, so that it includes the things which no longer or do not yet exist; as for non-existents, either we can count them amongst the existents or we can simply think of the falsity of the propositions about them.

3. AN EXAMPLE OF A DEMONSTRATION IN ALEXANDER'S COMMENTARY

Alexander presents philosophical demonstrations in the commentary on the part of IV which deals with the identity of the one and the existent, an identity which is put forward by Aristotle to justify the fact that the science of being as being will have to concern the one and its species as well.⁶⁶ Alexander's procedure consists in (i) explaining the identity (or rather the equivalence, as we shall see) between the predicates 'one' and 'existent', (ii) applying this equivalence to a species of substance (man), and (iii) presenting a series of possible deductions, justified only in part by the Aristotelian text.

Aristotle and Alexander seem to think of the identity of 'one' and 'being' ('existent') in terms of equivalence. Aristotle talks of the mutual implication between being and the one;⁶⁷ Alexander explains this implication by saying that 'one' is said of the same things as 'existent' is said, even if their definition is different.⁶⁸ So they are both thinking of a bi-conditional along the following lines:

x is existent if and only if x is one.

After offering his explanation, Alexander analyses the Aristotelian example illustrating this bi-conditional. We should notice that the Aristotelian text we read today (ταὐτὸ γὰρ εἷς ἄνθρωπος καὶ ὢν ἄνθρωπος καὶ ἄνθρωπος),⁶⁹ and the one we find in Alexander (ταὐτὸν γὰρ εἷς ἄνθρωπος καὶ ἄνθρωπος, καὶ τὸ ὢν ἄνθρωπος ταὐτὸν τῷ ἄνθρωπος εἶη ἄν, ὥστε

⁶⁵ There are demonstrations in relation to this last case, as for example the *reductio ad impossibile*, in which axioms are applied to impossible objects (for example, to two circles that intersect in three points).

⁶⁶ Arist., *Met.* IV 2, 1003b22–36.

⁶⁷ Arist., *Met.* IV 2, 1003b22–25: εἰ δὴ τὸ ὄν καὶ τὸ ἐν ταὐτὸν καὶ μία φύσις τῷ ἀκολουθεῖν ἀλλήλοις ὥσπερ ἀρχὴ καὶ αἷτιον, ἀλλ' οὐχ ὡς ἐνὶ λόγῳ δηλούμενα, κτλ.

⁶⁸ Alex., *In Met.* 247.4–5: ὅτι τὸ ἐν τῷ ὄντι ὁμοίως τε καὶ κατὰ τῶν αὐτῶν λέγεται. For the difference in definition, cf. above, on ὑπαρξίς.

⁶⁹ Arist., *Met.* IV 2, 1003b26–27. This is the text by Jaeger.

καὶ ἀλλήλοις ταῦτά)⁷⁰ say two different things. Aristotle says only that ‘one man’ and ‘a man that is’ are co-extensive (e.g. Plato is a man iff Plato is one man iff Plato is a man that is). What Alexander says is not only different, it is also ambiguous. We can give three versions of his argument depending on the sense we attribute to ταῦτόν.

First version:

- (i) one man = man
- (ii) existent man = man
- So (iii) one man = existent man.

This version has certain disadvantages. The first is that ‘=’ is ambiguous, meaning either equality or identity. But to speak of the equality of substance involves transgressing the limits of the Aristotelian doctrine, which holds that equality subsists only amongst quantities. As for identity, it is simply not true that there is an identity between ‘man’, ‘a man’ and ‘existent man’, for from a syntactical point of view identity is a relation between two proper names ($a = b$).

Second version:

- (i) man \Leftrightarrow one man
- (ii) man \Leftrightarrow existent man
- So (iii) one man \Leftrightarrow existent man

In this version, Alexander could be thinking of an equivalence, something like ‘x is a human being iff x is an existent human being iff x is one human being.’

The third version is suggested by Alexander’s subsequent account, where we find: “For what man signifies is also signified by one man and existent man”.⁷¹ We can then replace the ταῦτόν with ‘has the same reference as’ (for we have already seen that ‘one’ and ‘existent’ do not have the same sense).⁷² In this version, we will also have to change the arguments, and we will have to introduce quotation marks:

⁷⁰ Alex., *In Met.* 247.32–35: ὅτι δὲ ταῦτόν τό τε ὄν καὶ τὸ ἓν, ὡς προείρηκε, δεικνὺς ἐπὶ ἡγεγε ταῦτόν γὰρ εἰς ἄνθρωπος καὶ ἄνθρωπος, καὶ τὸ ὄν ἄνθρωπος ταῦτόν τῷ ἄνθρωπος εἶη ἄν, ὥστε καὶ ἀλλήλοις ταῦτά. The quote from Aristotle would then be ταῦτόν γὰρ εἰς ἄνθρωπος καὶ ἄνθρωπος, καὶ τὸ ὄν ἄνθρωπος ταῦτόν τῷ ἄνθρωπος. The words εἶη ἄν, ὥστε καὶ ἀλλήλοις ταῦτά should be attributed to Alexander. In his edition of the *Metaphysics*, Ross (1924) introduces Alexander’s version: ταῦτό γὰρ εἰς ἄνθρωπος καὶ ἄνθρωπος, καὶ ὄν ἄνθρωπος καὶ ἄνθρωπος, κτλ.

⁷¹ Alex., *In Met.* 247.35–36: ὅ τε γὰρ ἄνθρωπον σημαίνων ἓνα ἄνθρωπον σημαίνει καὶ ὄντα ἄνθρωπον.

⁷² Cf. above, p. 4.

Third version:

- (i) 'one man' is true of the same things as 'man' is true of
- (ii) 'existent man' is true of the same things as 'man' is true of
- So (iii) 'one man' is true of the same things as 'existent man' is true of.

On the basis of these equivalences, Alexander presents a series of deductive arguments that aim to explain the redundancy of 'one' and 'existent'.⁷³ We shall limit ourselves here to looking at Alexander's argument concerning the equivalence between 'one' and 'existent'.

First of all, it is noteworthy that Alexander's version of the Aristotelian example is an application of Euclid's argument of transitivity, or rather an adaptation of it to a type of substance: those that are the paradigmatic case of existents. But, as we have seen, for Alexander (and also for Aristotle) Euclid's argument is a common axiom, which leads me to the conclusion that what I have presented constitutes a concrete application of a common axiom to the science of existents⁷⁴ *qua* existents, for in Euclid's argument we find one of the *ὑπάρχοντα καθ'αυτά* of the existents.

This example brings us back to the problem of the use of the common axioms in philosophy. When Aristotle characterises the common axioms in IV he notes that everyone uses them insofar as it is appropriate to them, that is to say, in a use limited to the kind of which they are making demonstrations.⁷⁵ In the commentary on this passage,⁷⁶ Alexander takes Euclid's axiom and adapts it to geometry and arithmetic. More precisely, he adapts it to their kinds.

What Alexander says can be represented in the following way. Consider this axiom:

Ax.: things equal to the same thing are equal to each other.

A geometrician takes the axiom appropriate to his kind by applying it to magnitudes:

⁷³ Alex., *In Met.* 247, 37–248, 36, *ad Arist., Met.* IV 2, 1003b29–30.

⁷⁴ The example concerns substances, but our commentator considers another example of existents to which the equivalence between 'one' and 'existent' is applicable: the coming-to-be (*γενέσις*) and the perishing (*φθορά*); see Alex., *In Met.* 248.13–20, *ad Arist., Met.* IV 2, 1003b29–30.

⁷⁵ Arist., *Met.* IV 3, 1005a25–27: ἐπὶ τοσούτον δὲ χρῶνται ἐφ' ὅσον αὐτοῖς ἱκανόν, τοῦτο δ' ἔστιν ὅσον ἐπέχει τὸ γένος περὶ οὗ φέρουσι τὰς ἀποδείξεις. See also Arist., *APo.* I 10, 76a37–76b2: Ἔστι δ' ὅν χρῶνται ἐν ταῖς ἀποδεικτικαῖς ἐπιστήμας τὰ μὲν ἴδια ἐκάστης ἐπιστήμης τὰ δὲ κοινά, κοινὰ δὲ κατ' ἀναλογίαν, ἐπεὶ χρήσιμόν γε ὅσον ἐν τῷ ὑπὸ τὴν ἐπιστήμην γένει.

⁷⁶ Alex., *In Met.* 265.14–25.

Ax₁ (geometry): Magnitudes equal to the same magnitude are equal to each other.

An arithmetician will make the axiom appropriate to his genus by applying it to numbers:

Ax₂ (arithmetic): Numbers equal to the same number are equal to each other.

And similarly in the case of the other sciences.

In accordance with the above discussion concerning the example of man, philosophy will also use the common axioms by adapting them to its 'kind' and first of all to substance:

Ax₃ (philosophy): substances equal to the same substances are equal to each other;

Ax₄ (philosophy): a coming-to-be (γενέσις) or a perishing (φθορά) equal to the same coming-to-be (or perishing) are equal to each other.

And so on.

In the case of the existents, the use of the common axioms is complicated by the difficulties that I mentioned concerning the kind. The result is that, for each axiom, there will be ten versions, one for each category.

In the passage of the commentary on IV we are looking at, Alexander is thus using Aristotle's idea that the common principles can occur as premises of demonstrations only if they are limited to the kind whose properties we want to demonstrate. There is, however, another use of the common axioms, which is found in the commentary on the *Prior Analytics*, yet again in regard to Euclid's argument. It is worth remarking that the discussion is laid out in the framework of non-syllogistic arguments, and consequently, the potential conclusions can perhaps apply to demonstrations in general, at least up to a point. The discussion is obviously relevant, since, as we have seen, Alexander uses Euclid's argument for a philosophical demonstration, which he could quite well have presented in a syllogistic form. Here is what Alexander says:

(T4) The same sort of argument occurs⁷⁷ in the first book of Euclid's *Elements*, viz.: This is equal to this. But this is equal to this. Therefore: this is equal to this. This is indeed true, but there is need of a universal premise

⁷⁷ Alexander speaks of non-syllogistic arguments to which to his mind we should give a syllogistic form.

if it is to be deduced syllogistically. The premise is this: ‘things equal to the same thing are equal to each other.’⁷⁸

For Alexander, this last proposition is an axiom: Consequently, the argument must contain a universal premise in order to be well-formed, i.e. formally valid.⁷⁹

- (1) Things equal to the same thing are equal to each other,
- (2) $a = b$
- (3) $c = b$
- So (4) $a = c$.⁸⁰

It is reasonable to attribute to Alexander a theory according to which, in order to be a syllogism, the argument must contain a universal premise, or in order for it to be a demonstration, the universal premise must be an axiom.

Even if the involvement of the universal premise is limited to the case of syllogistic arguments, it seems to play two roles. In the example of Euclid’s argument, the introduction of the common axiom serves both to guarantee the formal validity of the argument and also to render explicit the foundation of the conclusion (i.e. its explanation). But it seems to me that it is reasonable to think that the universal axiom can play these roles also in philosophical demonstrations. Thus, if we turn to the case of the equivalence between ‘one’ and ‘existent’ as applied to man, we will have:

- (1) Things equivalent to the same thing are equivalent to each other,
- (2) One man and existent man are equivalent to man,
- so (3) One man and existent man are equivalent to one another.

As regards formally valid arguments, we might on the other hand think that the common axioms constitute for Alexander the truths on which the explanations of the conclusions of any scientific argument—thus also philosophical ones—ultimately depend.

⁷⁸ Alex. in *APr.* 22.3–7: τοιοῦτόν ἐστι καὶ τὸ ἐν τῷ πρώτῳ τῶν Εὐκλείδου Στοιχείων θεωρημα τὸ “εἰ τῆδε ἴση· ἀλλὰ καὶ ἥδε τῆδε· καὶ ἥδε ἄρα τῆδε ἴση”· καὶ γὰρ τοῦτ’ ἀληθὲς μὲν, ἀλλ’ ἐνδεῖ ἢ καθόλου πρότασις, ἵνα συνάγεται συλλογιστικῶς· ἔστι δὲ αὕτη “τὰ τῷ αὐτῷ ἴσα καὶ ἀλλήλοις ἐστὶν ἴσα”.

⁷⁹ Regarding these matters, see J. Barnes (1990), 83–84.

⁸⁰ More precisely, Alexander claims that, in order to have a perfect syllogism associated to the argument, we have to ‘condense’ (2) and (3) so that we have the following syllogism:

- (1) Things equal to the same thing are equal to each other
- (2) a and b are equal to the same thing (i.e. c)
- So (3) a and c are equal to each other.

4. CONCLUSION

In this article, I have tried to show how Alexander conceived of the science of being as being as constituting a demonstrative science. In particular, I have tried to show that Alexander thought it possible to apply the scientific conditions codified by Aristotle in the *Posterior Analytics* to ontology. Although it is difficult to discern the precursors of this theory, it is easy to see the great success this model of philosophy had in the history of philosophy after Alexander. The conception of metaphysics as a demonstrative science that I discern in Alexander actually had a fundamental influence on the philosophical tradition: we might mention not only Proclus' *Elements of Theology*, but also Descartes, Leibniz, Spinoza, as well as certain developments in so-called 'analytic' philosophy.

LES «SECONDS ANALYTIQUES» DANS LE COMMENTAIRE DE SYRIANUS SUR LA «MÉTAPHYSIQUE» D'ARISTOTE

ANGELA LONGO*

1. SYRIANUS: SA VIE ET SON OEUVRE

Syrianus, fils de Philoxène, fut le directeur de l'Ecole platonicienne d'Athènes à partir de 432 après J.-C. jusqu'à sa mort (probablement en 437 après J.-C.).¹ Il fut le maître d'Hermias et du plus célèbre Proclus. Parmi les ouvrages composés par Syrianus, seuls deux de ses commentaires ont survécu: son *Commentaire sur la «Métaphysique» d'Aristote* (sur les livres III, IV, XIII et XIV),² ainsi qu'un commentaire sur Hermogène (rhéteur, II-III^e siècle après J.-C.), à savoir sur le Περὶ ἰδεῶν et sur le Περὶ στάσεων (toutefois des doutes sur l'authenticité de ce dernier commentaire ont été soulevés).³ Enfin son disciple Hermias nous a transmis un *Commentaire sur le «Phèdre»*, qui est tiré de l'enseignement oral de Syrianus sur ce dialogue platonicien.⁴

* Je remercie vivement le Prof. F. de Haas d'avoir organisé le Colloque «Interpretations of Aristotle's *Posterior Analytics*» (Leiden, 2-4 juin 2004) ainsi que pour son invitation à y participer, tout comme je remercie le Prof. J. Cleary pour ses observations très utiles lors de la présentation orale de ma contribution. Ma reconnaissance va également au Prof. J. Barnes pour ses suggestions à propos de la version écrite de ce travail.

¹ Cf. Marinus, *Proclus ou sur le bonheur*, ed. Saffrey & Segonds (2001), § 12, 28-30, p. 15. Pour la littérature secondaire cf. Praechter (1932) and Saffrey & Westerink (1968), XII-XIV. Pour un examen précis des sources anciennes ainsi que pour une discussion récente des études principales sur la vie et les oeuvres de Syrianus cf. Cardullo (1995), 19-44 (signalons que, après ce premier volume de recolte de fragments, un deuxième volume a été publié: Cardullo (2000)) and (1987), 71-182. Saffrey & Westerink (1968, XVI-XVII) donnent des arguments en faveur de 437 après J.-C., comme date de la mort de Syrianus.

² L'édition courante, d'où sont tirées les citations du texte, est: Kroll (1902).

³ Syrianus, *In Hermogenem commentaria*, I-II, ed. Rabe (1913); pour les doutes sur l'authenticité cf. vol. 2, IV-VII.

⁴ Hermias Alexandrinus, *In Platonis «Phaedrum» scholia*, ed. Cuvreur (1901). À propos des commentaires rédigés sur la base de l'enseignement oral du maître cf. Richard (1950), 191-222. Ont récemment revendiqué une certaine originalité de la part d'Hermias, du moins dans certains endroits du commentaire, par rapport à l'enseignement de Syrianus Moreschini (1992), 451-460 (voir la réplique de Cardullo (1995), 26-28), et Bernard (1997), 4-23 (voir aussi le compte-rendu du travail de la Bernard fait par Bandinelli (1999), 288-291).

Au cours de sa carrière, Syrianus a consacré une large partie de son enseignement à l'explication des œuvres d'Aristote et de Platon, comme prévu dans le *curriculum studiorum* chez les Platoniciens de l'antiquité tardive.⁵ Nous savons que Syrianus a lu, avec Proclus, en deux ans, tous les ouvrages d'Aristote, en suivant un parcours didactique précis : d'abord la logique, puis l'éthique, la politique, la physique et la métaphysique (ou théologie).⁶ Pour ce qui concerne plus spécifiquement l'*Organon* d'Aristote, Syrianus aurait en tout cas fait l'exégèse des *Catégories*, du *De interpretatione* et des *Premiers analytiques*, comme le témoignent les commentateurs postérieurs d'Aristote, qui mentionnent et discutent les interprétations de Syrianus à propos de certains passages de ces ouvrages.⁷ En revanche nous n'avons aucune trace d'un commentaire écrit de Syrianus sur les *Seconds analytiques*.

Pourtant Syrianus connaissait bien ce traité d'Aristote, et il le mentionne à plusieurs reprises, de façon significative, dans son commentaire sur la *Métaphysique* d'Aristote. À ce propos, il faut rappeler que, en composant ce dernier commentaire, Syrianus a sous les yeux celui qu'Alexandre d'Aphrodise a déjà consacré à la *Métaphysique* (II–III^e siècle après J.-C.). À leur tour, les deux commentaires d'Alexandre et de Syrianus seront utilisés par Asclépius (VI^e siècle après J.-C.), dans l'élaboration de son propre commentaire sur la *Métaphysique*.⁸ Par conséquent, il sera utile de comparer les contextes où Syrianus mentionne les *Seconds analytiques*, dans son commentaire sur la *Métaphysique*, avec l'exégèse correspondante d'Alexandre et d'Asclépius. Cette étude de la mention des *Seconds analytiques* chez Syrianus nous permettra aussi d'apporter quelques modifications à l'index des *loci aristotelici*, établi par W. Kroll dans son édition du texte de Syrianus.

⁵ Pour ce qui est de la lecture des ouvrages d'Aristote cf. Hadot (1987), 249–285; (1991), 175–189; (1992), 407–425; et (1997), 169–176. À son tour, la lecture des dialogues platoniciens était ordonnée selon ce qu'on appelle le « canon de Jamblique », cf. Anonyme, *Prolégomènes à la philosophie de Platon*, ed. Westerink (1990), LXVII–LXXIV, 38–40; sur un tel canon cf. Festugière (1969), 281–296.

⁶ Cf. Marinus, § 13, 1–4, pp. 15–16.

⁷ Cf. Cardullo (1995), en particulier 35.

⁸ Alexander Aphrodisiensis, *In Aristotelis «Metaphysica» commentaria*, ed. Hayduck (1881); Asclepius, *In Aristotelis «Metaphysicorum» libros A–Z commentaria*, ed. Hayduck (1888). Sur les rapports entre ces différents ouvrages exégétiques cf. Luna (2001); et précédemment Luna (2000), 301–309; D'Ancona (2000), 311–327.

2. LES CONTEXTES DE LA MENTION DES «SECONDS ANALYTIQUES»

Il me semble que la mention des *Seconds analytiques* chez Syrianus soit adaptée à l'approche que ce philosophe platonicien adopte afin d'expliquer chacun des différents livres de la *Métaphysique*. J'ai essayé de montrer, ailleurs, que cette approche, bien que dans le cadre d'un projet philosophique unitaire, varie de livre en livre.⁹ En effet, en faisant l'exégèse du livre III de la *Métaphysique*, Syrianus est surtout préoccupé par le fait de donner une solution à chacune des différentes apories qu'Aristote avait présentées sans vouloir les résoudre (du moins à l'intérieur du livre III lui-même). Cette attitude de Syrianus, qui consiste non seulement à vouloir rendre les alternatives posées par les différentes apories d'Aristote explicites, mais encore à choisir son camp pour chacune d'elles, est une caractéristique significative, distinguant notre commentateur d'Alexandre, lequel n'a pas pour but d'avancer de solutions dans son exégèse de *Métaphysique* III.¹⁰

Ensuite, dans son exégèse du livre IV de la *Métaphysique*, Syrianus montre qu'il partage complètement la doctrine d'Aristote à propos du principe de contradiction, ainsi qu'à l'égard de sa défense contre d'éventuelles contestations à l'égard de ce principe. Il lui arrive même de proposer un argument supplémentaire à ceux déjà développés par Aristote.

En revanche, quand il s'agit de faire l'exégèse des livres XIII et XIV de la *Métaphysique*, l'accord avec Aristote se brise sérieusement et, souvent, un ton polémique s'installe. C'est dans ce contexte que Syrianus utilise «Aristote contre Aristote», à savoir la doctrine des *Seconds analytiques*, contre la négation, contenue dans la *Métaphysique*, de l'existence de substances mathématiques universelles séparées des objets sensibles.

Dans notre contribution, tout en considérant toutes les mentions explicites des *Seconds analytiques* dans le commentaire de Syrianus, nous nous concentrerons surtout sur l'utilisation polémique de cet ouvrage de la part de Syrianus dans l'exégèse d'Aristote.

⁹ Je me permets de renvoyer le lecteur à Longo (2005), et en particulier aux chapitres II et VI.

¹⁰ Cf. Syrian. *In Met.* III 1.20–21. Si le fait de vouloir donner des réponses explicites aux apories aristotéliennes, déjà dans l'exégèse sur *Métaphysique* III, distingue Syrianus d'Alexandre, en revanche il le rapprochera d'Asclépius (cf. Luna (2001), 142).

3. L'EMPLOI DES «SECONDS ANALYTIQUES» DANS «IN MET. III ET IV»

Dans son commentaire sur la *Métaphysique*, Syrianus mentionne sept fois, expressément, les *Seconds analytiques* : cinq fois en utilisant comme titre de l'ouvrage Τὰ ἀποδεικτικά (Syrian. *In Met.* 17.9; 69.34; 90.18–19; 160.16–17; et 164.6) et deux fois Τὰ ὕστερα ἀναλυτικά (Syrian. *In Met.* 19.25–26 et 30.21–22).¹¹

Il n'est en outre pas clair si, dans une autre occurrence, l'ignorance des analytiques (δὲ ἀπαιδευσίαν τῶν ἀναλυτικῶν, Syrian. *In Met.* 65.11; cf. Arist. *Met.* IV 3, 1005b3–4 Jaeger) caractéristique de ceux qui prétendent qu'il y a également une démonstration des axiomes, se réfère à l'ignorance de la logique en général ou à l'ignorance des *Premiers* et *Seconds analytiques* d'Aristote lui-même.

Deux fois on trouve l'expression, plutôt générique, «ailleurs» (ἐν ἄλλοις, Syrian. *In Met.* 98.19 et 164.10), bien que l'éditeur Kroll renvoie dans les deux cas aux *Seconds analytiques* (à savoir *APo.* I 7, 75b15 Ross dans le premier cas, et *APo.* I 8 dans le deuxième cas).¹²

On peut déjà affirmer que, à chaque fois que Syrianus fait référence aux *Seconds analytiques*, il fait mine d'approuver la doctrine qu'Aristote y avait exprimée (cf. Syrian. *In Met.* 17.9). Syrianus considère en effet la distinction, faite par Aristote, entre la définition et la démonstration d'une chose, telle qu'elle est formulée dans les *APo.* II 10, 94a1–2/12–13, comme un enseignement vrai et désormais acquis.¹³ Par ailleurs, il

¹¹ Grâce au TLG, j'ai pu constater que, parmi les commentateurs anciens d'Aristote, Alexandre n'emploie jamais le titre Τὰ ἀποδεικτικά (ni Thémistius (non plus)), mais qu'il écrit une fois ἐν τῇ Ἀποδεικτικῇ [*scil.* πραγματείᾳ] (*in Top.* 435.14); en revanche ce titre (Τὰ ἀποδεικτικά) est utilisé, à côté d'autres formes, par Ammonius (quatre fois), par Asclépius (deux fois), par Simplicius (cinq fois), par Olympiodore (une fois), par Jean Philopon (du moins sept fois dans les ouvrages authentiques), par Elias [David] (une fois) et par David (une fois). Les autres formes de titre, utilisées par les commentateurs aristotéliens pour indiquer l'ouvrage en question, étaient en plus de Τὰ ὕστερα ἀναλυτικά, Ἡ ἀποδεικτικὴ [*scil.* πραγματεία] ou Τὰ δεύτερα ἀναλυτικά; par Τὰ ἀναλυτικά, on indiquait tout simplement l'ensemble des *Premiers* et *Seconds analytiques*.

¹² A notre avis, *APo.* I 14 est plus pertinent. Enfin, dans *In Met.* 194.13, il n'y a aucun renvoi précis et on serait plutôt enclin à chercher un parallèle dans la *Physique* d'Aristote. Toutefois, Kroll, faute de mieux, renvoie à *APr.* II 17, 65b16.

¹³ On peut remarquer que déjà Alexandre, dans l'exégèse du passage aristotélien en question (*Met.* III 2, 996b18–22), avait renvoyé explicitement aux *Seconds Analytiques* et avait introduit, à cet endroit, l'exemple de la définition et de la démonstration de l'éclipse lunaire, exemple repris par Syrianus (cf. Alex. *Aphr.* *In Met.* 185.22–186.2).

affirme que la science, qui connaît la cause formelle de chaque chose, est capable d'en donner la définition ainsi que la démonstration.¹⁴

De surcroît, Syrianus partage la conviction aristotélicienne qu'il n'est pas possible de démontrer toute chose (Syrian. *In Met.* 19.25–26, cf. *APo.* I 3, 72b19–20). Cela constitue, pour Syrianus, un élément utile permettant d'affirmer que les axiomes ne sont pas démontrables, bien qu'ils soient connaissables par la science de la substance (mais pas par voie de démonstration). Syrianus résout ainsi la deuxième aporie aristotélicienne, en jugeant qu'une même science étudie non seulement les principes qui régissent tout ce qui est, mais aussi les principes des démonstrations. Cette mention des *Seconds analytiques* est à ajouter à l'index de Kroll, sur les passages aristotéliciens.¹⁵

Syrianus est aussi convaincu du fait que pour chaque espèce il y a une unique définition, au sens propre, et que cette définition est constituée à partir des genres, comme Aristote l'a dit dans les *Seconds analytiques* (Syrian. *In Met.* 30.21–22).¹⁶ Cela permet à Syrianus d'affirmer (également sur la base de la prémisse complémentaire: «une définition est constituée à partir de principes») que les genres doivent être considérés comme des principes plutôt que comme des éléments. Syrianus résout ainsi la sixième aporie aristotélicienne de *Métaphysique* III. Il est utile de remarquer que le renvoi explicite aux *Seconds analytiques* se trouve déjà dans l'exégèse correspondante d'Alexandre (Alex. *Aphr. In Met.* 204.13–14) et qu'il se retrouvera ensuite dans celle d'Asclépius (Asclep. *In Met.* 176.24–25), mais que ni Alexandre ni Asclépius ne l'ont utilisé pour trancher l'aporie aristotélicienne en question.

En un mot, tous les renvois explicites aux *Seconds analytiques*, contenus dans le commentaire de Syrianus sur *Métaphysique* III, servent non seulement à rappeler un enseignement aristotélicien, apprécié comme vrai, mais ils contribuent aussi à constituer la position de Syrianus sur la solution des différentes apories aristotéliciennes.

¹⁴ Cela est en rapport avec la solution que Syrianus donne de la quatrième aporie (cinquième dans la liste initiale donnée par Aristote au premier chapitre du livre III), consistant à dire qu'une même science étudie non seulement la substance, mais aussi les propriétés par soi de la substance (cf. Syrian. *In Met.* 22.18 ss.).

¹⁵ Dans l'exégèse du même passage aristotélicien (*Met.* III 2, 997a2–11) Alexandre ne mentionne pas les *Seconds analytiques*, cf. Alex. *Aphr. In Met.*, 188.16–190.17.

¹⁶ Kroll renvoie à *APo.* II 8 mais, selon Hayduck, il s'agirait plutôt de *Top.* VI 4, 141a35 (ἐκάστω γὰρ τῶν ὄντων τὸ εἶναι ἐν ἑστίν ὃ ἐστίν); cf. l'apparat critique de Alex. *Aphr. In Met.* 204.14; et d'Asclep. *In Met.* 176.24–27.

Dans son commentaire sur le livre IV de la *Métaphysique*, Syrianus mentionne une seule fois, de façon explicite, les *Seconds analytiques*, cela pour rappeler qu'Aristote y traite la proposition immédiate comme un universel (Syrian. *In Met.* 69.34; cf. Arist. *APo.* I 2, 72a7; I 3; I 4, 73b26 ss.). Ici, le commentateur partage le combat d'Aristote contre tous ceux qui contreviennent au principe de contradiction, ouvrant ainsi la porte à des conséquences absurdes, telles que l'élimination de l'οὐσία et de la proposition immédiate. En général, dans son commentaire sur le livre IV de la *Métaphysique*, Syrianus est très solidaire d'Aristote.¹⁷

4. ARISTOTE CONTRE ARISTOTE DANS «IN MET. XIII»

Venons-en maintenant aux passages, bien plus intéressants pour nous, du commentaire où Syrianus mentionne les *Seconds analytiques* dans le but de contester certaines affirmations aristotéliennes, contenues dans la *Métaphysique*, livre XIII. En expliquant les livres XIII et XIV, Syrianus polémique contre Aristote et soutient non seulement l'existence d'universaux mathématiques, mais aussi, et surtout, leur statut de substances séparées des sensibles, situées entre les sensibles, d'un côté, et les Idées, de l'autre.

Il ne s'agit pas d'un point de détail, au contraire: c'est un des critères principaux qui permet de distinguer un philosophe platonicien (tel Syrianus) d'Aristote et des philosophes péripatéticiens (tel Alexandre).

À ce propos, Syrianus met en œuvre une stratégie particulièrement pointue consistant à réfuter l'Aristote de la *Métaphysique*, par l'Aristote des *Seconds analytiques*, et à montrer une incohérence au sein même du système aristotélien. En suivant le fil des arguments de Syrianus, on peut arriver à la conclusion que, si Aristote veut (dans l'intemporalité de l'exégèse) être cohérent avec lui-même, il doit accepter l'existence et le rôle épistémique des universaux subsistant en dehors des sensibles.

En particulier, expliquant un passage de *Métaphysique* XIII (2. 1077a9–14), dans lequel Aristote soutient l'impossibilité de l'existence

¹⁷ En expliquant le même passage aristotélien (*Met.* IV 4, 1007a20 ss.), Alexandre avait déjà renvoyé explicitement aux *Seconds analytiques* (Alex. *Aphr. In Met.* 290.8). À son tour, non seulement Asclépius renvoie aux *Seconds analytiques*, mais il développe l'argument des *Analytiques* concernant l'universel, et propose l'exemple du triangle (Asclep. *In Met.* 265.4–8). Il est intéressant de remarquer que Hayduck, dans l'édition d'Alexandre, pense qu'il s'agit d'Arist. *APo.* I 3, tandis que, dans la suivante, d'Asclépius, il pense à *APo.* I 4, 73b26; Kroll aussi, dans l'édition de Syrianus, pense à *APo.* I 4.

des objets mathématiques en tant que substances séparées des objets sensibles, Syrianus mentionne explicitement les *Seconds analytiques*:

(T1) En effet si nous n'acceptons pas cela [*scil.* le fait que l'universel n'existe pas dans la matière], comment pourrions-nous encore sauvegarder le fait que toute cause démonstrative [*scil.* le terme moyen dans la démonstration] soit vraie de quelque chose de façon primitive, chose dont elle a la même extension et qui est universelle,¹⁸ comme tu [*scil.* oh Aristote] as l'habitude toi-même de considérer l'universel dans les *Démonstratifs*?¹⁹

Εἰ γὰρ δὴ μὴ τοῦτο καταδεξαίμεθα, πῶς ἂν ἔτι σωθῇ τὸ πᾶσαν αἰτίαν ἀποδεικτικὴν πρῶτως ὑπάρχειν τινί, ᾧ καὶ συνεξισοῦται καὶ καθόλου ὅστιν, ὡς εἰώθας αὐτὸς ἐν τοῖς Ἀποδεικτικοῖς τὸ καθόλου θεωρεῖν;

(Syrian. *In Met.* 90.16–19)

Syrianus se réfère en général à l'enseignement répété d'Aristote sur l'universel contenu dans les *Seconds analytiques* (cf. ὡς εἰώθας, l. 18)—à titre d'exemple, on peut rappeler *APo.* I 4, 73b39. Il indique que, selon Aristote, si A appartient de façon primitive à B, alors A a la même extension que B. Le fait que A appartienne de façon primitive à B veut dire que A appartient en soi à tout B. Par exemple le fait d'avoir la somme des angles internes égale à 180 degrés appartient en soi (= est vrai de façon primitive) à n'importe quel triangle en tant que triangle, et appartient de façon médiate aux triangles isocèles ou à ce triangle-ci.

Or—remarque Syrianus—étant donné qu'Aristote admet la vérité des axiomes utilisés par les mathématiciens, cela implique que ces axiomes soient vrais de façon primitive d'une quelconque chose, et que l'axiome et une telle chose aient la même extension universelle. Pour Syrianus, la chose à propos de laquelle un axiome mathématique est vrai (par exemple, le triangle) est non seulement une substance mathématique universelle, mais aussi séparée des objets sensibles. Il s'agit de *logoi* (principes rationnels psychiques) existant dans les âmes et ordonnant l'univers sensible.

Se basant sur la théorie de la vérité empruntée à Platon (*Rp.* VI 507 A : la ligne divisée, cf. Syrian. *In Met.* 90.29–31), selon laquelle pour tout acte de connaissance vraie, il y a un objet, dans le domaine de la réalité, auquel cet acte correspond, Syrianus considère qu'aux axiomes (qui font partie du domaine de la connaissance) doit correspondre quelque chose

¹⁸ Ou: «à qui elle s'égale et pour qui elle est universelle».

¹⁹ Dans cette section de son commentaire, Syrianus arrive à tutoyer Aristote, signe de son vif intérêt pour l'argument et de sa veine polémique. Pour une liste d'apostrophes à l'adresse d'Aristote dans le commentaire de Syrianus, cf. Luna (2001), 226.

dans le domaine de la réalité. En outre, Syrianus considère que la vérité des axiomes concerne de façon primitive des universaux qui sont des substances séparées des sensibles et présentes depuis toujours dans l'âme humaine.²⁰

Par ailleurs, en plus de la doctrine de l'universel, formulée dans les *Seconds analytiques*, Syrianus rappelle d'autres points aristotéliens doctrinaux, considérés comme vrais et en contraste avec la négation de l'existence d'objets mathématiques subsistant en dehors des sensibles.²¹

En d'autres termes, on peut tirer des arguments de Syrianus la conclusion que, si Aristote veut éviter de tomber en contradiction avec lui-même (à savoir avec sa thèse de la vérité primitive de quelque chose par rapport à quelque chose d'autre), il doit admettre l'existence d'universaux mathématiques en tant que substances séparées des sensibles et existant dans les âmes humaines. Remarquons-le, cela s'avère être en contradiction avec l'avis explicite d'Aristote, exprimé dans les *Seconds analytiques*, selon lequel pour qu'il y ait démonstration il faut un universel, mais pas un universel séparé, comme le sont les Idées, conçues par Platon!²²

Toujours dans le cadre de l'exégèse sur *Métaphysique* XIII, après un renvoi, explicite mais assez fugitif, aux *Seconds analytiques*, à propos des principes logiques,²³ un autre passage illustre la réactivation de l'âpre

²⁰ Ces universaux résident dans l'âme du monde non seulement comme causes de connaissance, mais aussi avec une force démiurgique, par rapport à l'univers. À ce propos cf. Longo (2001), 85–124.

²¹ Il s'agit de l'enseignement selon lequel la science en acte coïncide avec son objet (Syrian. *In Met.* 90.25–26; cf. Arist. *Met.* XII 7, 1072b20–21; *DA* III 4, 430a2–5; 5, 430a19–20; 7, 431a1 et b17); et de celui selon lequel l'intellect donne à l'âme les principes de la démonstration (Syrian. *In Met.* 90.36–37). À ce propos, Kroll n'indique pas de passages aristotéliens, mais je n'exclus pas qu'il s'agisse ici d'une interprétation au sens platonicien d'Arist. *APo.* II 19, 100b5–17, en particulier la ligne 15 (νοῦς ἂν εἴη ἐπιστήμης ἀρχή).

²² Cf. Arist. *APo.* I 11, 77a5–9: «ainsi il n'est pas nécessaire d'admettre l'existence des Idées, ou d'une Unité séparée de la Multiplicité, pour rendre possible la démonstration. Ce qui est cependant nécessaire, c'est qu'un même attribut puisse être affirmé de plusieurs sujets: sans cela, il n'y aurait pas, en effet, d'universel. Or s'il n'y a pas d'universel, il n'y aura pas de moyen, ni, par suite, de démonstration.» Traduction: Tricot (1995), 59–60.

²³ Cf. Syrian. *In Met.* 160.16–17, où la mention des *Seconds analytiques* est associée à celle du livre IV de la *Métaphysique*, ce qui fait penser que Syrianus a les principes des démonstrations à l'esprit, en particulier le principe de contradiction et le principe du tiers exclu. Dans les *Seconds analytiques*, le développement de l'argument des principes de la démonstration apparaît en plusieurs endroits de l'ouvrage, il est donc impossible d'indiquer un seul passage à ce propos. On peut plutôt penser à des chapitres entiers

polémique de Syrianus contre Aristote, où les *Seconds analytiques* sont invoqués. Le but de Syrianus est toujours de soutenir l'existence d'universaux séparés des sensibles ainsi que l'excellence de leur connaissance, par rapport à la connaissance des choses individuelles.

Expliquant un passage de *Métaphysique* XIII, dans lequel Aristote dit que la science en puissance porte sur l'universel, tandis que celle en acte porte sur ce qui est déterminé (τόδε τι, *Met.* XIII 10, 1085a15–25, en particulier 11, 15–18), Syrianus réplique :

(T2) Mais aussi le fait de dire [*scil.* de la part d'Aristote] que la science des universaux est en puissance, tandis que celle des individus est en acte,²⁴ est à l'évidence propre de quelqu'un qui, par amour des disputes envers les «philosophes» plus anciens, bouleverse ce qui a été dit par lui-même dans les *Démonstratifs*, à savoir qu'il n'est pas possible qu'il y ait une science des individus, et certes pas meilleure ni plus parfaite que celle des universaux.²⁵ (Syrian. *In Met.* 164.4–8)

τὸ δὲ καὶ τὴν μὲν τῶν καθόλου ἐπιστήμην δυνάμει λέγειν εἶναι, τὴν δὲ τῶν καθ' ἕκαστα ἐνεργείᾳ, φανερῶς ἀνατρέποντός ἐστι διὰ τὴν πρὸς τοὺς παλαιοτέρους φιλονεικίαν τὰ τε²⁶ ἐν τοῖς Ἀποδεικτικοῖς αὐτῷ ῥηθέντα, ὅτι τῶν καθ' ἕκαστα οὐκ ἐγχωρεῖ γίγνεσθαι ἐπιστήμην, μήτοι γε ἀμείνω καὶ τελειότεραν τῆς τῶν καθόλου.

Syrianus renvoie ici, comme l'éditeur Kroll l'indique, à *APo.* I 24, 86a5²⁷ et I 31, 87b37–39; Aristote y affirme qu'une démonstration universelle est meilleure qu'une démonstration particulière et que les universaux sont plus efficaces pour les démonstrations que les choses particulières. En outre, Aristote y soutient que la sensation porte (du moins de façon primitive) sur les choses individuelles, tandis que la science sur les universaux (*APo.* I 31).

Selon Syrianus, Aristote est incohérent avec lui-même et il risque de s'autodétruire, cela par rivalité à l'égard de certains philosophes qui l'ont précédé. Ici, Syrianus pense aux Pythagoriciens et à Platon, lesquels

comme, par exemple, à l'intérieur du livre I, aux chapitres 10–11, 19 et 32; et, à l'intérieur du livre II, au chapitre 9. Ce renvoi de la part de Syrianus aux *Seconds analytiques* est à ajouter à l'index des lieux aristotéliens de Kroll.

²⁴ Syrianus ne prend pas en compte la possibilité que l'expression τόδε τι puisse signifier autre chose qu'un particulier, à savoir la forme substantielle, comme le veut un interprète contemporain d'Aristote : Lear (1987), 149–174.

²⁵ Cf. aussi Proclus, *in Euclid.*, ch. 6, pp. 13, 27–14, 23 Friedlein.

²⁶ Le τε ne semble pas avoir de sens ici, le texte édité est problématique : cf. l'apparat critique de Kroll à cet endroit.

²⁷ Plus précisément, il s'agit de *APo.* I 24. 85b14–15; 86a3.

auraient soutenu, de façon commune, l'existence d'universaux mathématiques en tant que substances séparées des sensibles (cf. Syrian. *In Met.* 178.9–10).²⁸

Pour Syrianus, le remède à cette incohérence aristotélicienne consiste à garder l'enseignement sur l'universel des *Seconds analytiques* et à rejeter celui de la *Métaphysique*. Cela aurait le double avantage : (a) d'une part de restituer un système cohérent à Aristote, (b) d'autre part, de pouvoir accorder l'enseignement logique d'Aristote sur l'universel avec la doctrine pythagorico-platonicienne sur les universaux mathématiques.

Dans le même passage exégétique, Syrianus évoque aussi un autre enseignement des *Seconds analytiques* (ἐν ἄλλοις, Syrian. *In Met.* 164.10), selon lequel le syllogisme de type *Barbara* est indiqué comme étant le plus capable de démonstration et le plus à même de produire de la science en acte.²⁹ *Barbara* est constitué de deux prémisses universelles affirmatives dont on tire une conclusion également universelle et affirmative. Pour Syrianus, si on prenait pour bonne la position d'Aristote exprimée à la fin de *Métaphysique* XIII, on devrait au contraire penser que les syllogismes possédant une prémisse particulière sont meilleurs, cela étant vrai même pour une prémisse portant sur des choses individuelles (Syrian. *In Met.* 164.8–12).³⁰ Cela n'a toutefois pas de sens, étant donné que les universaux sont davantage susceptibles d'être connus, par rapport aux choses particulières et individuelles ; de sorte que Syrianus préfère garder l'enseignement aristotélicien des *Seconds analytiques* et, même, l'utiliser pour réfuter celui de la *Métaphysique* (livres XIII et XIV en particulier).

²⁸ Souvent dans son commentaire Syrianus neutralise la tentative aristotélicienne d'opposer ou de distinguer les Pythagoriciens des Platoniciens (cf., par exemple, Syrian. *In Met.* 142.2–38, avec la traduction ainsi que les observations de Cardullo (1993, 173–200, en particulier 191–193), qui souligne—entre autres—la dépendance de Syrianus par rapport à Jamblique, pour ce qui est de la notion de monade). Pour Syrianus il y a une unique école pythagorico-platonicienne, laquelle détient dans le temps la vraie doctrine ; dans cette conception, qui met en valeur la composante pythagoricienne (ou supposée telle), Syrianus apparaît l'héritier de Jamblique (cf. O'Meara (1989), 128–135, en particulier 130–131). Pour une analyse approfondie de la conception des entités mathématiques de la part des Pythagoriciens et des Platoniciens, telle qu'elle est présentée par Aristote dans la *Métaphysique*, cf. Cleary (1995).

²⁹ Comme Kroll l'indique, il s'agit d'Arist. *APo.* I 8.

³⁰ On peut trouver une analyse de ce passage de Syrianus, et une discussion de la question qu'il soulève à propos des prémisses universelles et particulières, dans Longo (2001).

6. CONCLUSION

Pour conclure, non seulement Syrianus connaissait les *Seconds analytiques* d'Aristote, mais il en avait une haute estime. Ces derniers sont mentionnés de façon explicite, à plusieurs reprises, au cours de son commentaire, et cela toujours avec approbation.

Ils deviennent même un instrument puissant de polémique lorsqu'il s'agit de contrer l'attaque menée par Aristote dans la *Métaphysique* (XIII et XIV) à l'égard de l'existence d'universaux mathématiques en tant que substances séparées des objets sensibles.

Cette stratégie argumentative de Syrianus correspond à son projet philosophique plus large : celui de *ne pas* harmoniser Platon et Aristote à tout prix et, plutôt, de faire une sélection dans le système d'Aristote. Syrianus entend en effet garder l'enseignement aristotélécien (de la logique et, en particulier, de la syllogistique) tout en faisant l'usage d'une ontologie d'inspiration pythagorico-platonicienne, qui soutient l'existence de principes rationnels universels dans les âmes humaines (en tant qu'images des Idées intelligibles) et leur confère un rôle épistémique majeur.

PART III

DEMONSTRATION, DEFINITION AND CAUSATION

ALEXANDER AND
PHILOPONUS ON *PRIOR ANALYTICS* I 27–30:
IS THERE A TENSION BETWEEN ARISTOTLE'S
SCIENTIFIC THEORY AND PRACTICE?

MIIRA TUOMINEN

1. INTRODUCTION

During the past decades one of the major questions of Aristotelian scholarship has been whether Aristotle in his scientific practice proceeds according to his own methodological instructions. The question has received so much attention, that it has become what G.E.R. Lloyd calls “a hoary old chestnut indeed”.¹ The puzzle, as is well known, arises from the observation that there is a tension or even a contradiction between the super-strict conditions on the premises of scientific proofs set out in the first book of the *Posterior Analytics* and the somewhat freewheeling dialectical manner in which Aristotle argues in the preserved scientific (and philosophical) works.

From a contemporary perspective it might seem that ‘the old chestnut’ has always been there—that it is a question that would have struck any reader approaching the works of Aristotle. This article began life as an attempt to see how old the chestnut really is. My initial hypothesis was that the ancient Greek commentators on Aristotle had started the discussion. I also thought that these commentators were the first to conclude that there is a tension between Aristotle’s theory of science in the *Posterior Analytics* and his actual scientific practice, and that their reaction had affected the reception of the *Posterior Analytics* in later times.

However, on the basis of my current findings about the ancient Greek commentaries on Aristotle and from what has become conspicuous in the conference on which the current volume is based, it seems that my expectations were misguided. The commentators do not seem to recognize such tension at all. They do not discuss the old chestnut, apparently

¹ Lloyd (1990), 371. For the discussion, see, e.g., Barnes (1969) and (1981); Bolton (1987); Gotthelf (1987); Lennox (1987); and Wians (1989) and (1990).

because they took it for granted that Aristotle presents a model for what a science should look like *when it is ready*, and that he provides various kinds of instructions for how to argue for conclusions—including scientific statements. In addition, from Alexander's commentary on the *Topics* we can extract a view about what it means to argue dialectically for scientific premises. We shall look at his discussion more closely below.

In the present article, I shall discuss Alexander's and Philoponus' comments on *Prior Analytics* I 27–30 and Alexander's comments on three crucial lines in the *Topics* I 2. In *Prior Analytics* I 27–30 Aristotle describes how arguments can be found with respect to any problem whatsoever by collecting predicates belonging or not belonging universally to subjects: the chapters thus provide guidelines for how to select predicates for the production of scientific syllogisms. James Lennox has recently noted that in the biological works Aristotle often aims at finding out precisely the same kind of connections between terms as the syllogistic scheme presented in the *Prior Analytics* I 27–30;² a similar point has been made in Finnish scholarship on Aristotle.³ In addition to the syllogistic scheme provided in the *Prior Analytics*, Aristotle makes some general methodological remarks in *Topics* I 2 that are of relevance to the question under investigation (particularly useful are the lines 101a26, 101a36, and 101b3). In short, Aristotle claims that dialectic is used in the philosophical sciences; that this method is especially useful for examining the premises or principles of the sciences; and that this is explained by the “evaluative” (ἐξεταστική) character of the dialectical technique. Alexander wrote a commentary on the *Topics* and his comments on 101a26 and 101a36 are of major importance for the present investigation. I shall discuss these comments in section 3.3 below. But let us first turn to the *Prior Analytics*.

2. ARISTOTLE'S SYLLOGISTIC SCHEME IN *PRIOR ANALYTICS* I 27–30

In *Prior Analytics* I 27, Aristotle introduces the subject matter of the passages at hand as a study of how we will always be well supplied with premises with respect to any problem or question. It is not sufficient to

² Lennox (2001), 34n.11, 18n.18, and 40–50.

³ Knuuttila (1994, 277–278) in Finnish.

know how every type of syllogism comes to be, but one also needs the power to establish any given conclusion by constructing a syllogism. To this end he first introduces a division of beings into three classes. These classes are the following:

- (i) things which are predicated of other things, but of which nothing is predicated (“top”);⁴
- (ii) things which are both predicated of other things and of which other things are predicated (“middle”);⁵
- (iii) things which are not truly predicated universally of anything, but of which other things are predicated (“bottom”).⁶

Aristotle announces that he will be concerned mostly with the middle class of entities (43a42–43).

We shall now provide an initial picture of how Aristotle constructs syllogisms for conclusions of all possible logical forms, and discuss a few examples in more detail below in section 3.

The conclusion we need to establish will be of one of the following four forms:

- (1) Universal affirmative (AaE): A belongs to every E.
- (2) Particular affirmative (AiE): A belongs to some E.
- (3) Universal negative (AeE): A belongs to no E.
- (4) Particular negative (AoE): A does not belong to some E.

In order to find the relevant premises for any conclusion, one should according to Aristotle do the following. One must posit each relevant term (A and E). Then one must gather (i) the predicates which universally follow the relevant terms (A and E); (ii) the predicates which are

⁴ *APr* 43a29–30, 36–40. Philoponus takes the ten categories as constituting the top class (*in APr*. 270.24).

⁵ *APr*. 43a30–32, 40–43; e.g. man and animal.

⁶ *APr* 43a26–29, 32–36; e.g. Cleon or Callias. The first class of things can only be predicated accidentally (*APr*. I 27, 43a35–36): e.g., “that white thing is Socrates” or “that approaching thing is Callias.” Philoponus calls such predication “unnatural” (παρά φύσιν) (*in APr*. 272.11–13). He distinguishes such unnatural predication from accidental predication, because whereas in the former a substance is predicated, the latter involves two non-substantial predicate terms predicated of each other (e.g. “that bald one is a philosopher”); see *In APr*. 272.13–15.

universally followed by the relevant terms; and (ii) the predicates which do not belong to either A or E.⁷ This gives us the following groups of predicates.⁸

		<i>For A</i>		<i>For E</i>
(i)	<i>B</i>	(XaA)	<i>F</i>	(YaE)
(ii)	<i>C</i>	(AaX)	<i>G</i>	(EaY)
(iii)	<i>D</i>	(XeA)	<i>H</i>	(YeE)

To argue for all the possible conclusions, the instructions are the following. Note that Aristotle assumes that the conclusion is all the time known beforehand. The purpose of the scheme is to find the appropriate premises for that conclusion.

(1) First, if we need to argue for a **universal affirmative** conclusion (AaE), we need premises of the form AaX and YaE. Such predicates are listed in groups C and F respectively. To establish the conclusion straightaway, X and Y have to be identical. (AaX, YaE ($Y = X \Rightarrow XaE$); AaE.) For instance, suppose we inquire into planets and have discovered that all the planets are non-twinkling (AaE, where E stands for “the planets” and A for the “non-twinkling”), and are curious to know how this conclusion can be argued for (cf. *APo.* I 13, 78b1–3). In order to do this, we need to find the same term in two places: among those terms that belong universally to planets (YaE) and among the terms to which non-twinkling belongs universally (AaX). Suppose now that, in our inquiries into astronomy, we have discovered that all the planets are near, as opposed to the fixed stars that are all far away (YaE where Y means “being near”). Suppose, then, that we have also discovered that non-twinkling belongs to all objects which are near (AaX). We might have recourse to optics, or just rely on a generalisation of the following kind of experience. For instance, we have seen a number of lighthouses while being at sea. The light of those that are nearby seems to remain stable whereas the light of the distant ones seems to twinkle. From this we might have generalised that it must be the case in general that distant lights seem to twinkle whereas those that are nearby remain stable. Now we can establish the conclusion that the planets do not twinkle by the following syllogism:

⁷ Since negative universal statements convert we do not need a fourth category of the form AeX or EeY, as these are equivalent to XeA (D) and YeE (H) respectively; see *APr* 43b5–6.

⁸ Knuuttila (1994) provides a similar, but not entirely identical scheme.

All objects that are near are non-twinkling.
 Planets are near.
 Therefore, planets are non-twinkling.

(2) For a **particular affirmative** conclusion (AiE) we can use two kinds of premises. For instance, we can establish that some pleasures are good (AiE where A is good and E is pleasure). This example appears both in Alexander and in Philoponus.⁹ Following the first path requires that we find a term so that both ‘good’ belongs universally to that term (AaX) and that ‘pleasure’ also belongs universally to that term (EaY), and $X = Y$. Such terms can generally be found in the groups C and G from the table. Suppose that when gathering the relevant terms for pleasure and good we have noticed that all virtuous actions are good (AaX) and that all virtuous actions are pleasant (EaY, and $X = Y$). On the basis of these premises we can now conclude that some pleasures are good:

All actions in accordance with virtue are good (AaX).
 All actions in accordance with virtue are pleasant (EaX).
 Therefore, some pleasures are good.

The second path is to look for a term which belongs to all good things (XaA) and to which pleasure belongs universally EaY ($Y = X \Rightarrow EaX$). The commentaries do this by identifying initially non-identical terms in the two columns corresponding to our groups B and G. We shall discuss this in section 3.2 below.

(3) If we have a **universal negative** conclusion (AeE), we again have two ways to go. We can either look for premises of the form XeA and YaE ($Y = X \Rightarrow XaE$), or XaA, YeE ($Y = X \Rightarrow XeE$). The first way is to look for a term which does not belong to any A (XeA) but which belongs to all E (XaE); such a syllogism can be made if the same term is found in both D and F. The second way is to find a term that belongs to all A (XaA), but does not belong to any E. These are listed in groups B and H above. An example can be extracted from the *Parts of Animals* (664a16–17):

All oviparous water-animals have a fish-spine (XaA).
 Dolphins do not have a fish-spine (XeE).
 Therefore, dolphins are not oviparous (AeE). (Dolphins are viviparous).

(4) Finally, for the construction of a **particular negative** conclusion (AoE), the relevant middle term needs to be such that it does not belong to any A (XeA), but that E belongs to all of it (EaY ($Y = X \Rightarrow EaX$)). The

⁹ Alex. *In APr.* 302.18–25, Philop. *In APr.* 277.20–22.

example comes from Philoponus' commentary.¹⁰ Let A be good and E be pleasure again. Now we need a predicate of which goodness is universally denied, but to which pleasure belongs universally. Such predications can be found in our scheme in the groups D and G. Philoponus chooses unnatural pleasure as the middle term. Now, no unnatural pleasures can be good, because being unnatural is completely outside the scope of being good (XeA). Because unnatural pleasures are pleasures after all (EaX), we can conclude that some pleasures are not good. (For those who doubt whether there are any unnatural pleasures, Philoponus points out that there is at least one: namely scratching an itch.)

Clearly, Aristotle is most interested in the group of predicates that belong universally. He adds¹¹ that, within this group, we need to distinguish between the essential properties (ἐν τῷ τί ἐστι); peculiar properties or *propria* (ἴδια); and those predicates which belong accidentally (ὡς συμβεβηκότα κατηγορεῖται). Concerning the accidental predicates, we must distinguish between those that belong to their subjects *truly* (κατ' ἀλήθειαν) and those that belong *as a matter of reputable opinion* (δοξαστικῶς). This distinction between belonging *truly* and belonging *as a matter of reputable opinion* is a reference to the distinction between dialectical and scientific premises, for in a dialectical context it is sufficient that the premises are reputable or endoxic. Aristotle defines acceptability or endoxicity in the *Topics* (I 1, 100b22–23) as follows: claims are reputable (ἐνδοξα) if they are accepted by all or the majority or by the wise, where “accepted by the wise” means that they are accepted by all of the wise people, or most or the best of them.

Finally, it is not enough that we only take those predicates which belong truthfully or doxastically to their subjects in a universal manner; we also need to list predicates which belong to subjects for the most part (ὡς ἐπὶ τὸ πολὺ).¹² As Aristotle indicates, the syllogistic form also applies to premises that hold for the most part, yielding a conclusion that holds for the most part. In the sublunary world many generalisations only apply for the most part, and Aristotle still wishes to welcome them into a natural science (cf. *APo.* I 30 and II 12, 96a6–19). Such generalisations

¹⁰ Philop. *In Apr.* 276.21–22.

¹¹ Arist. *Apr.* I 27, 43b5–10.

¹² Arist. *Apr.* I 27, 43b32–36.

include, for instance, that a beard grows for most men (*APo.* II 12, 96a11–12), and that it usually rains a lot in the winter, but sometimes also in the summer (*Phys.* II 8, 198b34–199a3; *Met.* VI 2, 1026b30–36).

Therefore, what Aristotle recommends us to do is to collect a list of all the different kinds of predicates that belong to a subject and to distinguish the way in which they belong: i.e. whether they belong essentially; as a peculiar property (*ἴδιον*); for the most part; or accidentally, and this either *truly* or *as a matter of reputable opinion*. The last mentioned category refers to the dialectical premises. As in the *Topics*, Aristotle here distinguishes between truth and endoxicity, where endoxic premises are not true, but only reputable.

From the start it has been clear that the scheme Aristotle is laying out here does not work as a tool for *determining* whether a predicate belongs as an essential or peculiar property, or whether it belongs universally or just for the most part. The procedure does not tell us how to show whether a predicate belongs at all. Therefore, Aristotle's scheme provides us with a powerful tool for the production of syllogisms *only* on the condition that we already know all the relevant relations (i.e. when we know that some predicate belongs to its subject doxastically or truthfully, or that it belongs essentially or as a *proprium*, etc.).

In *Prior Analytics* I, Aristotle describes the applications of the scheme and indicates its general nature:

(T1) The procedure described is to be followed in the establishment of all conclusions, whether in philosophy or in any art or field of study; we must scrutinize of our two terms what belongs [universally] to them and to what they belong [universally].¹³ One should have an abundance of these and we must proceed by way of three terms establishing conclusions in this way and refuting them in that way. If we want to proceed according to truth we need true premises, if we aim at dialectical syllogisms we argue from reputable opinions.¹⁴

(*APr.* I 30, 46a3–10; the translation is mine, based on Ross 1949.)

¹³ Here Aristotle omits saying “those to which our terms do not belong at all” (XeA and YeE) corresponding to the class of terms in (c), i.e. in D and H. One likely explanation is that negative conclusions and premises are not that common in the sciences about which he seems to be talking here, even though he does not use the word *ἐπιστήμη*.

¹⁴ Ἡ μὲν οὖν ὁδὸς κατὰ πάντων ἢ αὐτὴ καὶ περὶ φιλοσοφίαν καὶ περὶ τέχνην ὅποια νοῦν καὶ μάθημα· δεῖ γὰρ τὰ ὑπάρχοντα καὶ οἷς ὑπάρχει περὶ ἑκάτερον ἀθροεῖν, καὶ τούτων ὡς πλείστον εὐπορεῖν, καὶ ταῦτα διὰ τῶν τριῶν ὅρων σκοπεῖν, ἀνασκευάζοντα μὲν ὧδέ, κατασκευάζοντα δὲ ὧδέ, κατὰ μὲν ἀλήθειαν ἐκ τῶν κατ’ ἀλήθειαν διαγεγραμμένων ὑπάρχειν, εἰς δὲ τοὺς διαλεκτικούς συλλογισμούς ἐκ τῶν κατὰ δόξαν προτάσεων.

3. THE COMMENTARIES ON *PRIOR ANALYTICS* I 27–30

I shall now turn to the commentaries on the relevant chapters of the *Prior Analytics* I 27–30 in order to draw a more concrete picture of Aristotle's syllogistic scheme and to see how the commentators reacted to it. There are two extant commentaries on these chapters in the *Commentaria in Aristotelem Graeca*. One is by Alexander of Aphrodisias, the other by Philoponus; both are usually taken to be authentic.¹⁵ (There is also a commentary on the *Prior Analytics* by Ammonius, but for some reason his comments on the first book end right after the comments on chapter 26 of the first book. There is no explanation why he ends there, nor does he make a reference to anything which has been left out from the commentary of the first book.)

3.1. *Alexander on Prior Analytics I 27–30*

In discussing the syllogistic scheme of *Prior Analytics* I 27–30, Alexander uses one and the same example to show how all possible conclusions involving two terms, 'good' (ἀγαθόν) and 'pleasure' (ἡδονή) can be established:¹⁶

Let A be good and E be pleasure. For these the following groups of predicates can be gathered (Alex. Aphr., *In APr.* 301.17–32):

<i>A = good (ἀγαθόν)</i>		<i>E = pleasure (ἡδονή)</i>	
<i>Group B (XaA)</i>		<i>Group Z (YaE)</i>	
ὠφελιμόν	(useful)	ἡ λεία κίνησις	(soft movement)
ἀίρετόν	(preferable)	ἐνέργεια τῆς	(the unhindered
διωκτόν	(to be striven after)	κατὰ τὴν	actuality of a natural
οἰκεῖον	(appropriate)	φύσιν ἔξω	disposition)
λυσίτελές	(profitable)	ἀνεμπόδιτος	
συμφέρον	(agreeable)	τὸ ἀνενόχλητον	(untroubled)
ὀρεκτόν	(desirable)	τὸ ἀνόργητον	(non-violent)
		τὸ ἄρεστόν	(pleasing)
		τὸ ἄπονον	(effortless)
		τὸ ἄλυπον	(painless)
		τὸ ἄφοβον	(without fear)
		τὸ κατὰ φύσιν	(natural)
		τὸ αἰρετόν	(preferable)

¹⁵ See, e.g., Sorabji (1990a), 27–28.

¹⁶ Cf. Aristotle's discussion on pleasure and good in *EN* VII 11–14.

<i>Group G</i> (AaX)		<i>Group H</i> (EaY)	
εὐδαιμονία	(happiness)	ὑγεία	(health)
τέλειον	(being perfect)	εὐτυχία	(being lucky)
ἀρεταί	(virtues)	εὐτεκνία	(with a good progeny)
κατ' ἀρετήν	(action in accordance with virtue)	ἐνέργεια κατ' ἀρετήν	(action in accordance with virtue)
σωματικά ἀγαθά	(bodily goods)	εὐπορία	(wealth)
τὰ ἐκτός	(the external)		
τὰ κατὰ φύσιν	(the natural [goods])		
<i>Group D</i> (XeA)		<i>Group Q</i> (YeE)	
φευκτόν	(to be avoided)	νόσος	(sickness)
βλαβερόν	(hurtful)	πόνος	(trouble)
κακόν	(bad)	λύπη	(distress)
ἀσύμφορον	(useless)	φόβος	(fear)
ἀλυσιτελές	(non-profitable)	ἀπορία	(difficulty/poverty)
αἰσχρόν	(shameful)		
ἀτελές	(imperfect)		

In the column for good and that for pleasure only the following three predicates are literally the same: ‘natural’ (τὰ κατὰ φύσιν), ‘desirable’ (τὸ αἰρετόν), and ‘activity according to virtue’ (κατ' ἀρετήν ἐνέργεια). These three predicates would be sufficient for showing that either all pleasures are good, or that some pleasure is.¹⁷

However, Alexander does not stop after identifying the terms that are literally identical.¹⁸ In order to establish that every pleasure is good, Alexander does not use the predicate “natural”, but goes on to identify some terms from the one column with terms in the other column. For instance, he identifies perfect (τέλειον) with unhindered activity of a natural disposition (ἐνέργεια τῆς κατὰ τὴν φύσιν ἔξωως ἀνεμπόδι-στος). “Taking these two to be one,” Alexander says, “we make a middle term” (302.6). This move is based on a kind of definition for pleasure

¹⁷ For the conclusion that (a) all pleasures are good, “natural” (τὰ κατὰ φύσιν) would be a suitable middle term whereas the latter two would show only that some pleasures are good (b and c). (a) Being good belongs to all natural things; being natural belongs to every pleasure. Therefore, being good belongs to every pleasure. (b) Every good thing is desirable; every pleasure is desirable. Therefore, some pleasures are good. (c) All activities according to virtue are good; all activities according to virtue are pleasant. Therefore, some pleasures are good.

¹⁸ In fact, he uses terms that are literally identical only in establishing the particular affirmative conclusion “some pleasures are good” (all activities according to virtue are good, all activities according to virtue are pleasant; therefore, some pleasures are good, Alex. *In Apr.*, 302.18–25) and in a remark on the universal affirmative conclusion (302.7–13) implying that it can be established by using the “natural” as a middle term.

Aristotle gives in the *Nicomachean Ethics* (see *EN.VII* 12, 1153a14) according to which pleasure is unhindered activity of a natural disposition. Alexander, however, does not identify unhindered activity of a natural disposition only with pleasure—which seems to be implied in Aristotle’s “definition”—but also with being perfect (τελειότης).¹⁹

Alexander’s argument showing the negative universal conclusion (i.e., no pleasure is good) trades on the notion of movement (κίνησις) and its imperfect character (ἄτελής). This discussion also builds on the *Nicomachean Ethics* VII where Aristotle speaks about pleasure being a process (γένεσις) and about a process not being the same in kind with a goal (τέλος). Alexander’s syllogism is as follows: Every pleasure is a soft movement; every movement is imperfect; no good is imperfect. Therefore, no pleasure, since it is a movement or a process, is good. This argument in Aristotle’s *Ethics* derives from Plato’s *Philebus*²⁰ and, with a slightly different emphasis, is central to Aristotle’s discussion.

The argument for a negative particular conclusion that some pleasures are not good (304.19–30) is less clear. Alexander selects ‘unprofitable’ (ἀλυσιτελής) from D and ‘effortless’ (τὸ ἄπονον) from H! (At least, this is what Alexander says, even though τὸ ἄπονον is actually in Z). He then goes on to identify ‘unprofitable’ with ‘effortless’ (at 304.26 we find: ἀλυσιτελής, τοῦτ’ ἔστιν ἄπονον) and argues as follows: No unprofitable or effortless thing is good. Every effortless thing is pleasant. Therefore, there are some pleasures, which are not good. This is a kind of “no pain, no gain” argument. Perhaps there existed a proverb of this sort in Greek and Alexander used it here as a basis for his identification of effortless with unprofitable.

Two aspects of Alexander’s discussion are important here.

First, he allows the identification of terms with each other even though they are not literally the same. In some cases such a procedure seems reasonable: If we have a definition for a thing in one column and its name in the other, it seems acceptable to substitute one with the other. However, Alexander identifies things with each other even without a definitional identity, which adds a further complication to how we can apply the syllogistic scheme of the *Prior Analytics* I 27–30. One might suppose that in such cases he is allowing for identifications that rely on common

¹⁹ Cf. Aristotle’s definition of ‘being perfect’ in *Met.* V 16, 1021b12–1022a3.

²⁰ *Philebus* 53c–54a expresses the idea that pleasures are processes and as such different from the goals of the processes.

opinion. After all, he merely presents examples of how a conclusion in each syllogistic form can be established according to the scheme laid out by Aristotle. Alexander also follows Aristotle in just assuming that the double application of the scheme in scientific as well as dialectical contexts goes without saying. If such assimilation or identification is allowed, the scheme cannot be a mechanical tool, and may require even more tacit knowledge than I first noted.

Secondly, and more importantly, Alexander does not comment on the quality or truth of the premises in his discussion; he also does not seem to be interested in discussing for what purposes the syllogisms could be used.²¹

When commenting on Aristotle's remark in 46a3–10 Alexander indeed makes clear that the method presented is used in science:

(T2) This is a procedure (ὁδός) and method (μέθοδος)²² in all the sciences and arts which prove something appropriate by means of syllogisms (ἐν πάσαις ἐπιστήμαις καὶ τέχναις ταῖς διὰ συλλογισμῶν ἀποδεικνυούσαις τι τῶν οἰκείων) ... the procedure and method is necessary for a philosopher (φιλόσοφος), a doctor (ἰατρός), an orator (ὀρίτωρ), a cultured person (μουσικός) and everyone alike who is establishing something through syllogism (συλλογίζομενος). (Alex. Aphr. *In Apr.* 330.32–331.1).

Alexander's final comments are important for determining his view of the connection between *Prior Analytics* I 27–30 and his discussion of science in the *Posterior Analytics*: he says that the dialectical syllogisms are discussed in the *Topics*, but that the apodeictic ones are discussed in the *Posterior Analytics* (331.22–24). Once more this confirms that he believes that *Prior Analytics* I 27–30 give us instructions for the construction of both dialectical and scientific syllogisms, including truly apodeictic ones (given that the premises fulfill some strict conditions).

²¹ Alexander then goes on to say that for clarity's sake, one should say what has already been said by using letter symbols for terms (304.31). Therefore, he indicates that the scheme is intended to be perfectly general and independent of the current example. The question of pleasure and good, though, is a good example, because it is a question that belongs to ethical science and is also suitable for dialectic, because the philosophers have different views about it (in fact, Aristotle does not recommend one to defend the thesis that all pleasures are good, because it leads people to suppose that one has a bad character, not that he is maintaining the thesis just for the sake of argument, *Top.* VIII 9, 160b17–23). However, what we do *not* find in Alexander are comments on the uses of the scheme in dialectic on the one hand and science on the other.

²² Aristotle only speaks of ὁδός in this connection. It seems that we still lack a systematic study on the uses of μέθοδος in antiquity. Gentzler's collection (1998) does not include one.

Alexander, however, does not say how we are supposed to know whether the premises are of the truly apodeictic kind. He only indicates that the same syllogistic scheme is used both in science and in dialectic, and that the quality of the syllogism depends upon the quality of the premises.

3.2. Philoponus on Prior Analytics I 27–30

Philoponus uses the same example as Alexander, based on the terms ‘pleasure’ and ‘good’. Maybe the example was a basic instructional tool which was commonly used to illustrate Aristotle’s “method”, or perhaps Philoponus just borrows it from Alexander. In any case, Philoponus’ list of predicates is pretty similar to Alexander’s, with only a few changes and some terminological differences (Philop. *In APr.* 274).

<i>A = good (ἀγαθόν)</i>		<i>E = pleasure (ἡδονή)</i>	
<i>Group B (XaA)</i>		<i>Group Z (YaE)</i>	
ὠφελιμόν	(useful)	κίνησις	(movement)
ἀίρετόν	(preferable)	ἐνέργεια κατὰ	(activity according to
διωκτόν	(to be striven after)	φύσιν	nature)
οἰκείον	(appropriate)	ἀνεμπόδιστος	(unhindered life)
λυσιτελές	(profitable)	ζωή	
συμμέρον	(agreeable)	τὸ ἀνενόχλητον	(untroubled)
ἐφετόν	(to be pursued)	τὸ αἰρετόν	(preferable)
		τὸ κατὰ φύσιν	(naturally desirable)
		ὄρεκτόν	
<i>Group G (AaX)</i>		<i>Group H (EaY)</i>	
εὐδαιμονία	(happiness)	ὑγεία	(health)
τέλειον	(being perfect)	εὐδοξία	(having a good
κατ’ ἀρετὴν βίος	(virtuous life)		reputation)
κατὰ φύσιν	(natural)	εὐτεκνία	(good progeny)
εὐεξία	(good disposition)	κατ’ ἀρετὴν βίος	(virtuous life)
οὐ ἔνεκα	(that for the sake of	εὐπορία	(wealth)
	which)	ἀπονία	(painlessness)
		ἀφερεπονία	(freedom of sorrow)
<i>Group D (XeA)</i>		<i>Group Q (YeE)</i>	
φευκτόν	(to be avoided)	νόσος	(sickness)
βλαβερόν	(hurtful)	πόνος	(trouble)
κακόν	(bad)	φόβος	(fear)
ἀλλότριον	(inappropriate)	ἀπορία	(difficulty/poverty)
ἀλυσιτελές	(non-profitable)	παρὰ φύσιν	(unnatural movement)
ζημιώδης	(damaging)	κίνησις	
ἀτελές	(imperfect)		

Philoponus puts these predicates into a star-shaped map (*In APr.* 274), thereby illustrating how the syllogisms are constructed. One key assumption is left tacit in the picture: In order for us to make syllogisms involving predicates from the groups distinguished here, the predicates we pick from the two columns have to be the same. In Philoponus' example this condition is fulfilled in only one case: "Virtuous life" is found in both G and H, and these would entitle us to conclude a particular affirmative conclusion (some pleasures are good). "Natural" is found in both G and Z, but not in exactly the same form (κατὰ φύσιν vs. ἐνέργεια κατὰ φύσιν). Philoponus, however, takes them to be the same.

In contrast to Alexander, who did not say anything about the quality or truth of the premises, Philoponus comments explicitly on this issue. He says (*In APr.* 276.20–29) that it is true that movement (κίνησις) and being desirable (ὀρεκτόν) follow pleasure, that is, that every pleasure is a movement, and that every pleasure is desirable. However, he adds that it is only plausible (κατὰ δόξαν) but not true that every pleasure would be natural, because, for instance, scratching an itch is not natural. It is likely that Philoponus means that scratching an itch is not desirable by nature (even though it is pleasant), because nobody would want to have an itch just for the pleasure of scratching it. He is probably thinking of Callicles, who in Plato's *Gorgias* takes hedonism to such an extreme that he claims that a pleasure coming from scratching an itch can in itself be desirable and can make a life happy (see Pl. *Gorgias* 494 c–d). Anyway, Philoponus points out (*In APr.* 276.20–28) that when we show that every pleasure is good through a syllogism that has 'natural' as a middle term, this syllogism will not have true premises.²³

When commenting on *APr.* I 30, 46a3 (where Aristotle refers to the applications of the syllogistic scheme to both philosophy and the arts), Philoponus—in contrast to Alexander—does not use the word ἐπιστήμη explicitly. Instead, he says that logic (λογική) is a proper tool for philosophy. He adds, however, that a similar procedure is used in "vulgar" fields of study, too.²⁴ Indeed, in all cases, he says (see 305.12–21), inferences are made on the basis of common notions (κοινὰ ἔννοιαι),

²³ Philoponus also mentions another example that is relevant in this context, namely the claim according to which, for instance, 'being' can be predicated from the ten categories as genera. According to Philoponus, this claim is reputable, but not true. See *In APr.* 276.31–32; cf. 272.30–273.1 and 270.24.

²⁴ He refers to earlier treatments in the context of the vexed issue of the position of logic in philosophy, e.g. *in Cat.* 140.24–141.20, *in APr.* 7.23–8.21.

but the people who draw these inferences are ignorant of the method (μέθοδος). Philoponus probably means that all arts (he uses τέχνη in 305.16–18) presuppose some kind of capacity to draw inferences, which in fact functions in the same way as the syllogistic scheme of the *Prior Analytics*: people working in the vulgar fields use inference schemes of some sort, but without being aware of it.

However, even though the reference to science is not explicit in this context, Philoponus' rather keen interest in the quality of the premises as well as his sharp distinction between what is endoxic and what is true, indicates that he thinks that the syllogistic scheme can be used both for scientific and for dialectical purposes. All along in his commentary on *Prior Analytics* I 27–30, Philoponus uses distinctions which point to the scientific context. For instance, in 276.10–16 he distinguishes between predicates that belong to the essence (τὰ οὐσιώδη) and those that somehow supervene on or follow from these (τὰ ἐπουσιώδη). I think it is reasonable to suppose that the essential predications are needed in scientific proofs, whereas other kinds of predicates are useful for argumentation under less strict conditions. Philoponus also repeatedly uses the language of 'proof' (i.e., ἀποδείκνυμι and its derivatives; see, e.g., 276.31–32 and 273.10).

In addition to the distinction between truth and endoxicity, we also find in Philoponus references to the idea that a similar scheme can be employed in dialectic. When introducing the general outline of the scheme, Philoponus repeats Aristotle in saying that the predicates which belong to the middle class (i.e. predicates that are both predicated of other things and of which other things are predicated) are mostly the object of attention and inquiry. The example he uses, namely the question of whether the soul is immortal or not (273.10), is exactly the kind of problem that according to Aristotle is suitable for a dialectical discussion (see *Top.* I 11, 104b1–17, I 10, 104a5–7 and I 14, 105b19–29), for it is something about which the majority and the wise disagree, both with each other and among themselves.

3.3. *Alexander on the Topics*

As I indicated in my introduction, Alexander's commentary on the *Topics* is of great importance for determining the late ancient perception of the relationship between Aristotle's dialectic and science. So let us now turn to Alexander's comments on the crucial methodological lines of *Topics* I 2.

First, Alexander comments on *Top.* I 2, 101a26 (*In Top.* 27.7–29.16), where dialectic²⁵ is said to be useful for training, for rhetorical encounters, and for the philosophical sciences. Alexander identifies the philosophical sciences with logic, ethics, physics, and that which comes after the physics, i.e. metaphysics. Alexander's main point is that dialectic is good for philosophy, because it trains us by forcing us to examine opposing positions. He claims that it teaches us to find out easily on which side the truth lies. In addition, by making us familiar with convincing (but not scientifically true) conceptions and by teaching us the nature of convincing, we learn from dialectic how not to be misled by such convincing (but not scientifically true) positions and not to mistake them for the truth. At the end of his comments he says that dialectic teaches us to see (συν-ορᾶν) how the aporias are solved.²⁶ The gymnastic aspect of dialectic is emphasised throughout.

When commenting on *Top.* I 2, 101a36 (where Aristotle says that furthermore—ἔτι δέ—dialectic is good for examining the first principles of science), Alexander dwells on whether examining the first principles of science is a further, fourth, use of dialectic, or a subdivision of the third of its aforementioned applications (i.e. philosophy). He settles for the answer that dialectic used for the examination of the first principles of science is subordinated to its use in philosophical science. Alexander repeats Aristotle's point that the first principles cannot be proven because nothing is prior to them, and the premises of proofs must be prior to their conclusions. He also notes that mostly our conviction of the principles comes about through induction (ἐπαγωγή).

Finally, Alexander explains how dialectic can be used in philosophy, while using examples from physics and geometry (*In Top.* 30.19–26).²⁷

²⁵ In the prooemium (*In Top.* 1.8–19), Alexander points out that the term “dialectic” is used differently by different authors. The Stoics are said to use the term for “speaking well,” which has two subspecies: speaking truthfully and speaking appropriately. Plato uses it for a philosophical method of collection and division. In Alexander's discussion of Aristotle's definition of dialectic the main question seems to be how it differs from rhetoric. The differentia is taken to be that rhetoric only deals with ethical or political questions whereas dialectic is completely general.

²⁶ For συνορᾶν related to distinguishing truth from falsity in a dialectical context, see also Arist. *Top.* VIII 14, 163b10.

²⁷ His first example is Aristotle's argument in the *Physics* that shows that no body can be infinite (ἄπειρον) on the basis of an—according to Alexander—endoxic premise that every body is limited or defined by a plain to which Aristotle supposedly added that “no infinite thing can be limited” (οὐδὲν δὲ ὁρισμένον ἄπειρον) (Alex. *In Top.* 30.12–17). Alexander continues that this makes clear that it is a dialectician's job to judge or argue

According to Alexander, a geometrician posits as a premise (τίθεται) that a surface is that which only has length and breadth; a geometrician also posits that a line is length without breadth, and that a point (σημεῖον)²⁸ is that of which there are no parts (οὐ μέρος οὐδέν). However, Alexander says that some people oppose this by saying that no quantity (μέγεθος) can be two-dimensional,²⁹ and that the point has even less, namely only one dimension. Therefore, according to these people, a point cannot exist at all; for there is nothing which does not become bigger through addition and smaller through diminution (this argument is said to originate from Zeno the Eleatic). This discussion among mathematicians and/or philosophers provides an occasion for Alexander to show how a dialectician can *argue for* each or any one of the debated options. Alexander shows at length (*In Top.* 30.26–31.21) how the existence of a point can be established dialectically. The main point of the argument is that a limit is never the same as that whose limit it is. The limit cannot be the same as that whose limit it is, because a limit has one dimension less than that whose limit it is. The sequence Alexander has in mind is the following: body → surface → line → point. It is assumed that such defining by limits cannot go on forever, but that some notions are basic. ‘Point’ is here probably taken as such basic notion: because lines exist and points are limits of lines, points must exist.

The relevant aspect of Alexander’s discussion of the *Topics*, however, is that when discussing the argument for the existence of a point he gives an example of how dialectic is used to establish premises of a science. This shows that Alexander takes it for granted that dialectic can be used to establish the premises to someone who does not believe that they are true.

In sum, Alexander takes dialectic, on the one hand, to train us to distinguish between truth and falsity and, on the other hand, to provide us with means to establish the truth of the premises to someone who does not yet grasp that they are true. Therefore, it seems that for Alexander dialectic is not a method of inquiry; we are just trained to ‘see’ possible solutions or distinguish the truth from falsity.

(λέγειν) about the principles (30.18–19). The set of examples is itself an illustration of the fact that principles become known by induction, as Alexander repeatedly emphasizes, e.g. *In Top.* 30.3–5.

²⁸ Alexander also uses the more familiar στυμή interchangeably with σημεῖον.

²⁹ I take the Greek διάστημα and its derivatives here to refer to the dimensions.

4. CONCLUSION

Let us now conclude the main aspects of the discussion.

First, I found no indication that Alexander and Philoponus would have seen any tension or contradiction between Aristotle's theory and practice of science. By contrast, they seem to think that Aristotle's picture of techniques of argumentation and logic is unified and that the syllogistic scheme Aristotle gives in *Prior Analytics* I 27–30 is used to construct both dialectical and scientific arguments, including scientific proofs. Alexander makes clear that the syllogistic scheme of the *Prior Analytics* I 27–30 pertains to questions studied in more detail in the *Topics*. This, in fact, is what Aristotle says himself (in *APr.* I 30, 46a28–30). The arguments are apodeictic when their premises are true and primary, and dialectic when they are endoxic.

This explains why these commentators did not believe that all of Aristotle's works (should have) consisted of ready made syllogisms. In every field of theoretical study which can be counted as a science, there is an intelligible structure to be found in the background, and a scientist should try to find out what this structure is like. For instance, if we study animals, we must pay attention to predicates that are shared universally among different species. In this way, we can group animals into larger classes that have some properties in common, because they share a common nature. Additionally, the fact that Alexander and Philoponus use an ethical example indicates that they follow Aristotle in assuming that there is a similar intelligible structure to be found in ethics as well.

Second, in commenting on the syllogistic scheme of the *Prior Analytics* I 27–30, the commentators remark only briefly on the applications of the scheme. Alexander mentions ἐπιστήμη explicitly whereas Philoponus only speaks of philosophy. He, however, repeatedly uses the language of 'proof' (ἀποδείκνυμι) and makes careful distinctions between different kinds of essence-dependent predications. In addition, Philoponus is careful to point out that even though in his example all pleasures can be shown to be good, the premises of this syllogism are not true. They depend on the assumption that all pleasures are natural, and this, according to Philoponus, is not true.

Third, in Alexander's commentary on the *Topics* we find his view on how dialectical arguments are to be used in philosophical sciences and—in particular—in establishing the principles of the sciences. His discussion shows two functions. One is to train us to see the truth; the other is to provide us with a means to argue for the premises in case

someone questions their truth. Nevertheless, for Alexander dialectic is not a method of inquiry: dialectic does not establish the true premises of scientific proofs for us, but it gives us appropriate intellectual training so that we will be capable of distinguishing between truth and falsity, in the sciences as well as in all other areas of human endeavour.

TWO TRADITIONS IN THE ANCIENT *POSTERIOR ANALYTICS* COMMENTARIES

OWEN GOLDIN*

1

The *Posterior Analytics* is one of Aristotle's most underspecified texts. Because it is written in such an abbreviated style, it is often unclear what are the questions that Aristotle is asking, let alone what are the answers he gives. This is so especially for the first half of Book II (1–10). In these chapters Aristotle is concerned with being and essence, and the different sorts of accounts of them offered by the sciences. But what exactly is the sense of the guiding question: can a demonstration and a definition allow us to know the same thing (II 3, 90a35–90b3; II 8, 93b15–20)? What is the underlying problem? What solution does Aristotle propose, and what are its philosophical implications?

The theory of demonstration that Aristotle presents in the first book of the *Posterior Analytics* is incomplete. As it stands, it is too weak to account for the explanation for any but the most trivial facts considered by a science. How exactly does Aristotle's view that states of affairs are explained through syllogisms grounded in definitional first principles square with the great variety of the states of affairs that science is thought to explain? I argue that at least some of the ancient commentators interpreted *APo.* II 1–10 as Aristotle's own attempt to deal with the problem. These commentators took Aristotle's view to be that when we explain a state of affairs, we often understand it as a case in which the nominal

* This paper has its source in some prepared remarks delivered prior to reading 'Atoms, Complexes, and Demonstration: Philoponus and Pacius on *Posterior Analytics* 96b15–25,' to the European Science Foundation Conference: Interpretations of Aristotle's *Posterior Analytics*, Leiden University, Leiden, Netherlands, June 2, 2004. (The paper I delivered has since been published as Goldin, 2004.) I am grateful to Frans de Haas and the European Science Foundation for having made it possible for me to participate in this unprecedented gathering of those who study and perpetuate the great tradition of *Posterior Analytics* commentary.

definition of an attribute is inherent in some basic subject of the sciences. The inherence of this nominal definition, in turn, can be syllogistically proven on the basis of definitional first principles. Those who followed this line of interpretation, I claim, are following the lead of the lost commentary of Alexander of Aphrodisias. There is an alternative account of *APo.* II 1–10, which takes these chapters to present not a solution to structural problems in the theory of demonstration, but an account of how a syllogism can serve to identify conceptually distinct aspects of a single reality. This line of interpretation makes its first extant appearance in what has come down to us as Philoponus' commentary on the *APo.* II.¹ Whatever its authorship, the line of interpretation it develops is of intrinsic interest, and is of historical importance on account of its influence on the Latin medieval philosophical tradition. My task here is to clarify the philosophical and exegetical issues that lay behind the choices made by this author (henceforth referred to as Philoponus(?)) and by Alexander before him.²

¹ The commentary is available as Wallies (1909), 334–440. On the question of authorship, see Wallies (1909), v–vi, in which Wallies argues against attributing the commentary on *APo.* II to Philoponus on the following grounds: 1) The commentary on *APo.* II is much less expansive than that on *APo.* I; 2) In the Commentary on *APo.* I, Philoponus often mentions in disagreement Alexander of Aphrodisias, but there is no such mention in the commentary on Book II; 3) The commentary on *APo.* II often cites the authority of Ammonius (referred to as 'the Teacher' or 'the Philosopher', while Philoponus avoids this in his commentary on *APo.* I; 4) The transmission of the two books is different. Only the later codices of the commentary on *APo.* I append to it the commentary on *APo.* II in question, while earlier codices append what has come down to us as the Anonymous Commentary. So, Wallies asks, if we defer to internal evidence and do not attribute the Anonymous Commentary to Philoponus, why should we not do the same for the *APo.* commentary in question? I do not believe that these considerations are decisive. Even if the author of the *APo.* II commentary does not explicitly bring up the name of Alexander, he presents an account of II 8–10 that radically departs from the interpretation of Alexander and many who followed him (or so I shall argue). This independence in thinking through the issues and the texts is representative of Philoponus. Nonetheless Wallies's arguments do tell against taking the two commentaries to be of a piece. Perhaps they were written at different times; perhaps the commentary on *APo.* II is a shortened version of a lost commentary by Philoponus. I do suspect that Philoponus is indeed at least an important source for the *APo.* II Commentary presented under his name in CAG (consider the arguments for authenticity in Kroll (1916), 1776–1777). I nonetheless follow the convention of referring to its author as Philoponus(?).

² Philoponus(?)' line of interpretation roughly corresponds to that which Detel (1993), 625–626 attributes to the ancient and medieval commentators; while that of Alexander corresponds to the interpretation he calls that of many modern commentators. If the argument of this paper is successful, I have shown that this latter line of interpretation has ancient roots.

I begin with what I claim is the Alexandrian reading of the chapters. I first identify a problem in Aristotle's philosophy of science as it is developed in the *Posterior Analytics*. I sketch what I have elsewhere argued is Aristotle's solution to the problem, presented in *Posterior Analytics* II, and then argue that the evidence strongly suggests that Alexander of Aphrodisias read the text in this way. (I proceed in this way because the surviving evidence is so fragmentary. It will be clearest to work through an interpretation of Aristotle, and then support attributing it to Alexander, than to begin by reconstructing Alexander's interpretation on the basis of text evidence.) I then turn to the reading presented in Philoponus(?)' commentary on *APo.* II, according to which Aristotle is concerned to show how different kinds of scientific accounts clarify different aspects of the essence of a kind, and how the relation between these accounts corresponds to the relation between these aspects of the essence.

2

In *Posterior Analytics* I Aristotle makes a number of claims concerning demonstration. First, the basic logical form of demonstration is Barbara: All Ss are Ms, all Ms are Ps; therefore all Ss are Ps (I 24). Second, both the minor and major premises are either indemonstrable or demonstrable on the basis of premises that are indemonstrable, expressing the features of the world that serve to explain the conclusion (I 2, 71b16–72a14).³ Third, definitions are conjunctions of indemonstrable predications, and every indemonstrable premise of demonstration is a conjunct of a definition.⁴

³ Or they must be demonstrable on the basis of premises that are demonstrable on the basis of premises ... that are indemonstrable, where the ellipsis denotes a chain of finite length. Aristotle explicitly argues that such a chain must be finite in *APo.* I 19–22.

⁴ Aristotle never comes right out and says this, but it follows from Aristotle's division at I 2, 72a14–24 of first principles into common axioms (general principles of inference which are not themselves demonstrative premises), hypotheses (assertions of being) and definitions (expressions of what the subjects of the sciences are). There are alternative ways of understanding the particular passages in which Aristotle discusses the kinds of demonstrative principles, but no other account had currency in antiquity, and no other way of tying the passages together has found widespread acceptance in current literature. The most vexed issue is that of understanding what are the assumptions of being of a kind, identified with hypotheses (I 10, 76a31–36; I 2, 72a14–24; I 10, 76b3–16). Like most commentators, I take these to be claims that there is such a thing as the kind in question. See McKirahan (1992), 36–49, 122–132 and Goldin (1996), 41–77. For a defense of definitions as the source of all ultimate demonstrative premises, see McKirahan (1992), 111, 287–288, n. 1.

The simplest form of demonstration is that in which both premises are indemonstrable; more complex cases will be reduced to a series of such simple demonstrations. Let S be the minor term, M be the middle term, and P be the major term. As we have seen, all of the principles that mention kinds S, M, and P will be derived from definitions. The definition of a kind predicates its genus and differentia of the definiendum.⁵ A genus may itself be analyzable as genus and differentia. Accordingly, M must be the genus of S,⁶ and P must be either the genus or the differentia of M. For example, a canonical demonstration will have this form: 'All humans are bipeds, all bipeds are animals; hence all humans are animals.' At best this merely renders explicit what is already given in the definition of the minor term, animal. But demonstration is surely meant to do more than render explicit genus/species relationships. For example, it is said to be the proper form for geometrical demonstrations (such as the proof that all triangles have the sum of their interior angles equal to two right angles; I 24, 85b7–15) and biological demonstrations (such as that by which it is explained why certain plants shed their leaves; II 16, 98b3–16).

Aristotle is either confused or, in spite of both his explicit and implicit assertions, he thinks that scientific definitions do not necessarily conform to the genus + species form. Two contemporary scholars who have squarely faced the problem have argued for the latter line of interpretation. For McKirahan, the first principles of demonstration are 'fat definitions' which do indeed implicitly contain all of the demonstranda. These 'fat definitions' are to be distinguished from genus + differentia definitions, which are thought to play a different role in Aristotelian science.⁷ Likewise, for Tierney, the principle of demonstration is not a definition (which is an expression of *to ti ēn einai*, and, Tierney grants, has a genus + differentia form) but a posit of the 'what is it?' (*ti esti*), which is distinct from definition and includes all of the essential (that is, demonstrable) attributes of the subject.⁸ Both strategies deny that demonstrations

⁵ This teaching is clearly put forward in *Top.* VI 4, 141b25–26. Within *APo.* it is expressed at I 22, 83a39–b1, and is presupposed by the hunt for definitions through division as described in II 13. On this see McKirahan (1992), 111–115.

⁶ If it were a differentia of M, then, since differentiae are not themselves definable kinds, there would be no first principle from which there can be derived the major premise M is P.

⁷ McKirahan (1992), 111–121. McKirahan admits that there is no explicit recognition of 'fat definitions' in the text, but takes the argument of *APo.* to require them. He argues that the sort of definition discussed in *PA* I, which results from a sequence of multiple concurrent divisions, satisfies the conditions for a 'fat definition.'

⁸ Tierney (2001).

expose causes or reveal explanations that might not be apparent even to those who have mastered the principles of the sciences. Such an account sits ill with Aristotle's reliance in Book 1 on geometrical proofs as examples of demonstrations, and with the three examples from the natural sciences that dominate Book II (explaining shedding of leaves by pointing to the congealing of the sap as its cause, explaining thunder by pointing to quenching of fire as a cause, and explaining the lunar eclipse by pointing to the interposition of the earth).

3

I have advocated another interpretation of Aristotle's solution to this difficulty.⁹ I here briefly sketch this solution. In section 4, I show that the evidence points to its being derived from the lost commentary on the *Posterior Analytics* of Alexander of Aphrodisias, which influenced surviving texts in which the interpretation is found (Themistius, an anonymous commentary on *Posterior Analytics*,¹⁰ and, in a confused form, in Eustratius).¹¹

1) Each science has its own subjects, those basic beings that are considered the substrate of every other being that is studied by that same science (I 7, 75a38–75b2; I 10, 76b11–16). Every substantial kind is such a subject (of some science) but not every such subject is a substance. For example, the basic mathematical kinds are inherent in substances, so they are not basic ontological substrates. But the mathematical sciences consider them as basic subjects, ignoring the natures of the substances in which they are inherent. Hence for mathematics, the basic kinds (units, lines, and so forth) are basic subjects.¹²

At I 4, 73b5–8, Aristotle distinguishes a sense of *kath' hautō* according to which a certain sort of *kind* or *thing* (in contrast to a predicate or predication) is *kath' hautō*. The sense of these lines is terse and obscure, but on one interpretation, Aristotle is using the phrase to denote the basic

⁹ Goldin (1996); see also Goldin (2004). In all respects but one, the main lines of my reading of II 8–10 derive from Ross (1949). Ross does not see that his account of the demonstration discussed in II 8 requires the use of the definitions of more than one basic subject, what I have labeled point 5.

¹⁰ Wallies (1909), 545–618.

¹¹ Much of the evidence is collected and discussed in Moraux (1979).

¹² See I 1, 71a12–17 in conjunction with I 7, 75a38–75b2 and I 10, 76b11–16; on this, see Goldin (1996), 41–77.

kinds that are the subjects of the sciences, as well as the things that fall under them. I too employ the term *kath' hauta* to refer to the kinds that are considered as ultimate subjects by the sciences that study them.

However, there is a closely related sense of *kath' hauta*, from which this first sense must be distinguished. According to this sense, a term, predicated of a subject in the definition of that subject¹³ is *kath' hauta* in respect to that predicate (I 4, 73a34–37). Since the first sense of *kath' hauta* that I have mentioned is the third mentioned by Aristotle in *APo.* I 4, and the second I have mentioned is the first mentioned in *APo.* I 4, I distinguish the two senses as *kath' hauta*₃ and *kath' hauta*₁, respectively.

So the problem to which I have drawn attention can be expressed as follows: how exactly is it that a predicate that is not *kath' hauta*₁ in respect to a *kath' hauta*₃ subject can be demonstrated of that subject?

2) Predicates that are *kath' hauta*₁ in respect to a subject are not themselves ontologically distinct from it, and the science that studies them does not take them to be distinct. That is why Aristotle says that a definition, which identifies these predicates, expresses the *what it is* (*ti esti*) of a kind. The subject is the totality of features expressed in the definition. There is no distinction between what the thing is and these features. All of the definitional predicates denote the same thing, albeit at different levels of specificity.

3) If a *kath' hauta*₃ kind has an eternal, necessary feature, of the sort that can be rendered explained or rendered intelligible by a scientific demonstration, and this feature is not *kath' hauta*₁, then it is something ontologically different from the subject in which it inheres. A middle term of the demonstration of the inherence of this feature in a subject identifies a cause of this inherence. Since all of the basic unmediated premises of a demonstration are *kath' hauta*₁, its minor premise must be a definition of the subject. Hence an attribute of the kind in question (the major term of the demonstration) can be said to have a cause other than itself, since the middle term of the demonstration will be *kath' hauta*₁ of the minor term. This is exactly how Aristotle refers to such kinds (II 8, 93b19; II 9, 93b21, 26). They are to be distinguished from the subjects of the sciences themselves as well as those attributes that are predicated of them *kath' hauta*₁.

¹³ I take this to include all attributes that are included in a definition that renders all genus/differentia relationships fully explicit. For example, I take terms predicated in the definition of the genus of the subject to be, in this sense, *kath' hauta* of the subject.

4) How is it that an attribute that is not *kath' hauto*₁ of a subject can be demonstrated to hold of that subject? There are two key steps to Aristotle's solution. First, even though the demonstrated attributes are not basic kinds, they are features of the world that appear with some regularity and are recognizable as such. Hence there are terms in our language by which we refer to them. In each case there will be an account of what the term signifies (identifying those features by which those without a scientific account identify its reference). This will be a nominal definition, as distinguished from the sort of scientific definition that expresses the essence of a *kath' hauto* kind (I 10, 76b5–11; II 8, 93a17–24; II 10, 93b29–32). To demonstrate that such a demonstrated attribute inheres in its subject is to show how, given the existence of the subject, the subject necessarily exhibits those features that are indicated in the nominal definition of this demonstrated attribute.¹⁴ To demonstrate the existence of an attribute P is to demonstrate S is P, of some attribute S. Sometimes the nominal definition of P includes S; in that case, to demonstrate that P exists is to demonstrate that all of the other attributes in the nominal definition of P are predicated of S. If it does not, then demonstrating that P exists is simply to show that the elements in the nominal definition of P are present in some subject.

5) For reasons reviewed above, such a demonstration requires at least one principle besides the definition of the minor term. So the definition of some other term must be employed as a source of a principle. Since demonstrations are of eternal or regular truths (I 8), they must appeal to relationships among basic kinds that are themselves eternal or regular. That is to say, a demonstration will identify connections, juxtapositions, or concatenations, on the basis of which it can be shown that certain features or states of affairs regularly follow of necessity.¹⁵ If these features are those that are identified in the nominal definitions of the attributes or events in question, it can be shown why these attributes or events must exist, predicated of or in relation to the basic kinds whose

¹⁴ One's provisional understanding of a kind (the partial grasp one has of the attribute in question) is identified in an account of the sense of the term by which we refer to the attribute. Aristotle includes such a nominal definition in his account of the various senses of 'definition' (II 10, 93b29–32). For a full defense of this view, see Charles (2000), 23–109.

¹⁵ The 'kind-crossing' that this involves is admittedly the weakest point of the interpretation; it seems to violate the rules laid down in I 9. Further, there is no direct evidence to attribute to Alexander this aspect of my interpretation; see section 4, below. But in my view, greater problems face all other ways of putting together the evidence both of Aristotle's accounts and Alexander's interpretation of Aristotle's accounts.

definitions are taken to be principles. For example, the various celestial bodies have necessary juxtapositions from which follow those characteristics that are identified in the nominal definition of a lunar eclipse. Likewise, clouds and fire necessarily come together in the way that leads to the quenching of fire that leads to the distinctive noise that we identify with thunder (II 8, 93a21–b12).¹⁶ The basic kinds of earth and plant are always conjoined (since earth is predominant in the material constituents of a plant); hence it can be shown that the leaves of certain plants must fall, when there is congealing of the sap at the point at which they are attached (II 16, 98b36–38). This is how we demonstrate that flat-leaved plants shed their leaves. A different sort of example is that in which mathematical entities enter into certain necessary relations by which complex entities are built on the basis of mathematical simples whose definitions are assumed (I 10, 76a31–36, cf. I 1, 71a14–24; II 10, 93b29–32).

6) There is no unmediated scientific definition of the sort of thing that has a cause other than itself, since it is not itself a basic kind studied by the sciences. But that is not to say that there is no sense in which it belongs to a science to account for what such a thing is. For Aristotle emphasizes that the ‘what it is’ is the same as the ‘why it is’ (II 2, 90a14–15); an adequate definition must express the cause of the being of the thing. Hence in the case of beings that do have a cause other than themselves, the scientific definition will need to express the cause of this kind. But it cannot simply express this cause, for in the case of such a thing, the cause is something *different* from the thing. Rather, an adequate scientific definition of such a kind will express both the conjunction of attributes that are given in the nominal definition of the kind and the middle term that expresses why these attributes are in fact found together. For example, the definition of a lunar eclipse is a privation of light from the moon, caused by the interposition of the earth. The demonstration of the inherence of the kind in question is therefore also a demonstration by which the scientific definition of this kind is made known and is verified. In this sense (and only in this sense) and only in respect to such a kind, is there a demonstration of a definition (II 8, 93b18–20; II 9).

This line of interpretation was adopted by Alexander, and in this he was followed by Themistius, the author of the *Anonymous Commentary on the Posterior Analytics*, and, in part, by Eustratius.

¹⁶ For a similar suggestion, see Ackrill (1983), 381–382.

4

Because of the fragmentary nature of the evidence for Alexander's *Posterior Analytics* commentary, the argument for ascribing to him this line of interpretation is not straightforward. The surest evidence is collected in Moraux (1979). Moraux shows how Philoponus, Themistius, Eustratius, and some scholiasts all had access to Alexander's commentary, and convincingly argues that the Anonymous Commentary is based on a condensed version of Alexander's commentary.¹⁷ We are on especially sure ground in tracing points of interpretation back to Alexander when his name is cited as a source. Sometimes one source gives us the attribution to Alexander while a parallel source is missing the attribution but provides fuller details of this line of interpretation. In such instances, the second source provides evidence of what the first source left out of its account of Alexander's interpretation. Moraux himself is conservative and restricts himself to such evidence, but he does suggest that the Anonymous Commentary as a whole is directly derived from a shortened and simplified version of Alexander's lost commentary, and hence is good evidence of its contents.¹⁸ Similarly, Themistius' commentary can be used as corroborating evidence, even when Alexander is not there referenced.

In his commentary on *Posterior Analytics* II 8, Eustratius tells us that he presents the interpretation of Alexander, adding his own clarifications.

(T1) As we promised, from here on in our account what we say will follow Alexander. For we must not refuse to accept the contributions of others, especially when they come from philosophic men who (unlike us) take their main task to be the clarification of the writings of Aristotle (while we are expounding them in the present work as a side-project at the request of friends). Nonetheless, it would be wrong to allow the considerations brought forth by that man to be deprived of the additional remarks that we make for the sake of more precisely discerning the matter at hand.¹⁹

We are grateful for Eustratius' preservation of stretches of Alexander's commentary, less so for Eustratius' unannounced interpolations. For, as we shall see, the account that Eustratius presents is in fact an uneasy combination of two lines of interpretation.

¹⁷ Moraux (1979), 3–8, 142–143.

¹⁸ Moraux (1979), 142–143.

¹⁹ Eustratius, 123.24–31; Moraux (1979), 95–96. This and other translations from Eustratius, Themistius, and Philoponus(?) are by the author.

It is on Eustratius that we must primarily rely, in reconstructing Alexander's account of *APo.* II 8, although we must purge his commentary of elements that clearly have another source (or, perhaps, were presented by Alexander as competing interpretations, and were not understood as such by Eustratius). Themistius and, especially, various scholia and the Anonymous Commentary are to be used as collaborating evidence. We do not have Alexander's own exposition of *APo.* II 1–10, and the evidence we have does not give us a single continuous line of interpretation. Accordingly, I will go through each of the six headings of section 3. For each point will review the evidence, more or less direct, that the line of interpretation presented there is of Alexandrian provenance.

1) A science is concerned with two kinds of entities, the basic subjects and the attributes demonstrated of those subjects. The former are the *kath' hauta*₃ entities, the entities *kath' hauta*₁ in respect to them constitute their essence, and are expressed in their definitions. The attributes demonstrated of those subjects are not *kath' hauta*₃.

The distinction between basic subjects and demonstrated attributes is fundamental to Aristotle's theory of demonstration; no cogent account of the *Posterior Analytics* is possible without appealing to it. The point on which interpreters differ is a mere terminological one. Does the interpreter recognize the sense of *kath' hauta* we have labeled *kath' hauta*₃? The terminological issue is important for our purposes. This is because one of the main interpretative issues dividing the two interpretative traditions of II 8–10 concerns how to understand Aristotle when he restricts his remarks on how a definition can become clear through demonstration, to certain cases: ὅν ἐστὶ τί ἕτερον αἴτιον τῆς οὐσίας (II 9, 93b26). Do we understand this as a restriction of the demonstration of the essence to one of two different kinds of things (things that have a cause other than themselves, as opposed to things that do not) or do we understand this as a restriction to one of two different kinds of definitional predications (mediated definitional predications, as opposed to unmediated ones)? Although as we shall see Eustratius presents both accounts, it is Themistius who most clearly takes this qualification to the effect that the 'demonstration of a definition' is restricted in a certain kind of *entity*. He does so by saying that it is restricted to the definition of those entities that are not *kath' hauta*.²⁰ There is no other passage in Themistius' paraphrase

²⁰ Themistius, in *APo.* 50.19–29: Ἐκεῖνο μέντοι γε ἀναγκαῖον διορίσασθαι, ὥς οὐκ ἐφ' ἀπάντων τοῦτο συμβαίνει ὅν ζητοῦμεν τοὺς ὁρισμούς, ἀλλὰ τῶν ἄλλοις ὑπαρχόν-

in which he refers to *kath' hauta* entities, as opposed to *kath' hauta* propositions, not even in his account of the senses of *kath' hauta* discussed in *APo.* I 4.²¹ So Themistius here appeals to a technical sense of *kath' hauta* of which he himself does not provide an account. This is evidence that Themistius is borrowing this terminology from another commentator. I suggest that commentator is Alexander.

In *Met.* V 18, 1022a32, Aristotle discusses one sense of *kath' hauta* with the following cryptic remark: ἔτι οὐ μὴ ἔστιν ἄλλο αἴτιον τοῦ γὰρ ἀνθρώπου πολλὰ αἴτια, τὸ ζῶον, τὸ δίπουν, ἀλλ' ὅμως καθ' αὐτὸν ἀνθρώπος ὁ ἀνθρώπος ἔστιν. 'Another point is that that of which there is no other cause is *kath' hauta*. For there are many causes of man: animal, biped, but nonetheless the man is a man on account of himself (*kath' hauton*).' In his commentary on the *Metaphysics*, Alexander expands a bit:

(T2) He says that 'in virtue of itself' also means 'that which has no other cause,' and he explains what this means by adding an example. For there are many causes of the fact that the man exists—his form, his matter, and each of the constituents in his definition, and moreover the cause that produced him—but there is no cause, outside [the man himself], of the fact that the man is a man. For if one has been asked *why* the man is a man, he can make no other answer than, 'Because he is a man.'²²

των, οἷον ἐκλείψεως, βροντῆς· ταῦτα γὰρ τὰ ἀποδεικτά, καὶ ἄλλο ἐπὶ τούτων τὸ μέσον τε καὶ τὸ αἴτιον τοῦ συμπεράσματος καὶ τοῦ πράγματος. ἐπὶ δὲ τῶν καθ' αὐτὰ ὄντων καὶ μὴ ἐν ἄλλῳ οὐκέτι οἷόν τε ἐφ' ἁπάντων τῇ αὐτῇ χρῆσασθαι μεθόδῳ· οὐ γὰρ τὸ (τοῦ) εἶναι αἴτιον ἄλλο ἐστὶν ἐφ' ἁπάντων, οἷον τῶν πρώτων καθ' ἑκάστην ἐπιστήμην, ἃ καὶ εἶναι καὶ τί ἐστὶν ὑποθέσθαι δεῖ ἢ ἄλλον τρόπον φανερὰ ποιῆσαι, ἐξ ἐπαγωγῆς ἢ πίστεως ἢ ἐμπειρίας, καὶ οὐ δι' ἀποδείξεως τὰ τοιαῦτα· ἀρχαὶ γὰρ εἰσιν ἀποδείξεως. ὅπερ ἤδη ποιοῦσιν αἱ ἐπιστήμαι· καὶ γὰρ τὸ εἶναι μονάδα καὶ τί ἐστὶ μονάς, ὁ ἀριθμητικὸς ὑποτίθεται. 'Yet we must make this distinction, that this is not so for all things of which we seek the definitions, but only those that belong to other things, such as eclipse and thunder, for these are demonstrable, and for these things the middle term is something different and is the cause of the conclusion and the fact. But in regard to things that are *kath' hauta* and are not predicated of anything else, it is no longer appropriate to make use of the same method for all things. For there is not in all cases some other cause of being, for all things, for example, there is not for the primary things in each science, for which one must hypothesize the being and the what it is, or in some other way make them clear, from induction or trust or experience, and such things are not made clear by demonstration, for they are principles of demonstration. This is exactly what the sciences now do. For the arithmetician hypothesizes the being of the monad and what the monad is.' Themistius goes on to anticipate Aquinas in giving the example of God, another primary being, whose existence cannot be demonstrated in the strict sense.

²¹ Themistius, 10–11.

²² Alexander, *In Met.* 416.22–28. The translation is from Dooley (1993), 101.

Alexander's contribution here is to say that when we say that a human being has no cause other than himself, we are saying that those features responsible for the fact that the matter of a certain kind are not external ($\xi\omega\theta\epsilon\nu$) but are rather internal to that kind. Aristotle elsewhere helps us to understand what such an internal cause is. At *Met.* VII 17, 1041a21–24 he points out that to ask why an X is an X is a vain inquiry, unless we are asking why some Y is an X. To ask why a man is a man is to ask why the body of the man is human; the answer is that the form is in matter (1041b6–9). The form of a kind X will be the primary cause of substances of kind X only if X is a natural (*Met.* VII 7, 1032a15–30) or immaterial substance. Accordingly, we may well interpret Alexander here as ascribing to Aristotle a sense of *kath' hauto*, according to which it refers to such substantial kinds, which are basic insofar as there is no other basic kind that is responsible for their being. Nothing excludes our understanding this sense as also applying to basic kinds that are not natural substances, for these too have no other kind that will explain why they are the sort of thing they are. (This is why for such things existence is assumed, not proven.) So Alexander's commentary on *Met.* V 18 provides some additional support that he recognized the sense of *kath' hauto* that I am calling *kath' hauto*₃.

More evidence that Alexander himself employed the phrase *ta kath' hauto* in regard to the basic subjects is found in the testimony of Eustratius, discussed below.

2) At II 8, 93a5–6; 93b18–19, and II 9, 93b21–22, 26–27 Aristotle distinguishes what does not have a cause other than itself from what does, and tells us that the sort of demonstration that reveals a definition holds only in regard to the former. For each of these passages there are two possible ways of understanding the Greek. On one account, Aristotle says that the sort of demonstration he has in mind holds only in regard to the sort of *definition* that has a cause other than itself. On the other, Aristotle says that the sort of definition that he has in mind holds only in regard to the definitions of things of a certain kind, those with causes other than themselves. As we shall see, Philoponus(?) develops the first line of interpretation. The Commentary of Eustratius gives us the best evidence that Alexander developed the second line of interpretation.²³

²³ These is corroborating evidence in the scholiast on II 10, 94a15–16 (reconstructed and discussed in Moraux (1979), 114–117) where Aristotle says that it has become clear $\kappa\alpha\iota\ \tau\acute{\iota}\nu\omega\nu\ \epsilon\sigma\tau\iota\ \kappa\alpha\iota\ \tau\acute{\iota}\nu\omega\nu\ \omicron\upsilon\chi\ \epsilon\sigma\tau\iota\nu$ a demonstration of the essence (I discuss the first half

The evidence is not unambiguous, though, since the first line of interpretation also finds a place in Eustratius' commentary.

Eustratius understands the purported demonstration of a definition as follows: 'the clouds have fire being quenched; fire being quenched makes noise; therefore the clouds have noise within them.' Given that the term 'thunder' has its sense fixed through a nominal definition such as 'noise in clouds', the above demonstration allows one to discern the definition of 'thunder' as 'noise in the clouds caused by the quenching of fire' (123.1–22). Eustratius repeats Aristotle's qualification that such a demonstration does not hold for what has no cause other than itself. 'This would seem to be so for the things that exist *kath' hauta* (ἐπὶ τῶν καθ' αὐτὰ ὑπαρχόντων). For if someone were to prove this for substances, in respect to some substrate, the middle term would be taken to be the cause of the essence, as Alexander says, but this is not properly speaking a demonstration (126.17–25).' Here Alexander is explicitly cited as the source for the view that the demonstration discussed in II 8 is not applicable in the case of substances.

Eustratius gives human being and *nous* as examples of *kath' hauta* things, whose definitions can in no sense be demonstrated. The definition of 'human being' is 'rational mortal animal', which is the same as the definiendum. This is also true for the definition of *nous*, 'what is receptive of science' (126.14–15). The dualistic metaphysics implied by the second example, rejected by the uncompromising hylomorphist Alexander, indicates that this is an interpolation of the neoplatonist Eustratius. The Anonymous Commentary, following much the same wording in its account of Aristotle's point, presents as an example only 'human being', here taken to have as its definition 'biped footed animal' (565.15–18). This is evidence that Alexander, the common source of the two commentaries, simply made the point that human being, a substantial kind, is not different from the definition of human being, and hence

of this scholiast, which can be reliably traced to Alexander, below). Alexander denies that there are demonstrations of definitions of immediates (οἱ τῶν ἀμέσων ὁρισμοί; I take it that definitions of immediates are immediate definitions) and of definitions in respect to the form and the cause (τῶν κατὰ τὸ εἶδος καὶ τὴν αἰτίαν). It would be reasonable for Alexander to say that the definitions of *basic subjects* alone are unmediated (that is, are posited as first principles) and alone express the formal cause (for the middle term of a demonstration of the inherence of an attribute will necessarily refer to the material or efficient causes that are responsible for the inherence of the attribute in one or more basic subjects). But the scholiast does not give us evidence that Alexander made these connections.

does not have a cause other than itself, but did not himself offer a definition of human being while making his point.²⁴

Aristotle himself gives an example of that which has no other cause: the monad. The arithmetician assumes both the meaning of the term 'monad' and its existence (II 9, 93b25); hence he does not employ a demonstration to make clear the definition of the monad. The passage could be taken to say that the definition of monad can in no way be demonstrated because that *definition* has no prior cause, but Eustratius explains it as meaning that it is the monad itself that has no cause other than itself, while the things compounded of the monad (that is, presumably, the numbers) do have such a cause. Eustratius explains how a right angle does have a cause other than itself, since it comes about when one straight line is made to intersect another straight line in a certain way.

(T3) But this is not how things are in the case of the monad, for it is not a derivative thing while the fact that a single particular being is said of it is prior by nature, but it exists and at the same time each single thing among the beings is said in respect to it. This is why the 'what it is' is not different from it.²⁵ (127.39–128.3)

On the other hand, Eustratius gives as examples of what does have a cause other than itself demonstrated attributes such as the privation of light on the moon (which, when caused by the interposition of the earth, is an eclipse) and noise in the clouds (which, when caused by quenching of fire, is thunder); neither of these are attributes that are definitional of their subjects. Eustratius makes clear that only in regard to such things can there be a demonstration clarifying the definition of some kind. He indicates that the middle term by which this attribute is demonstrated to hold of its subject is the 'cause other than itself' by virtue of which it is

²⁴ Before this, Eustratius presents Philoponus(?)'s account of that which has no cause other than itself in II 9 and 10, as referring not to the sort of thing for which there can be no definition of an essence, but as the sort of definition for which the demonstration Aristotle discusses is not applicable (106.5–107.11; 112.30–113.20). He uses Philoponus' own example of how 'anger' has two definitions, a material and a formal definition, which are 'different' from one another because they do not convert. Eustratius mingles the two lines of interpretation without seeing that this is what he is doing. That he does not derive the interpretation we see in Philoponus(?) from Alexander is indicated by 113.21, which immediately follows his presentation of Philoponus(?)' interpretation: 'But the things that Alexander says about this, we will say as we work our way through the text' (ἀ δὲ περὶ τούτου φησὶν Ἀλέξανδρος, ἐροῦμεν τὴν λέξιν ἐπεξιόντες).

²⁵ ἀλλ' οὐκ ἐπὶ τῆς μονάδος οὕτως· οὐ γὰρ πρότερον φύσει ὑπάρξαντος τοῦ κατ' αὐτὴν ἐν τῶν ὄντων ἕκαστον λέγεσθαι αὐτὴ ἠκολούθησεν, ἀλλ' ἅμα τε αὐτὴ ἐστὶ καὶ κατ' αὐτὴν ἐν τῶν ὄντων ἕκαστον λέγεται· διὸ οὐδ' ἔστιν αὐτῆς τὸ τί ἐστὶν ἕτερον.

possible for there to be this demonstration, which both shows why the attribute exists and serves to reveal its definition.²⁶

3) We recall that on the interpretation under consideration, to demonstrate that a non-definitional attribute exists is to show why there must be those characteristics that are expressed in the nominal definition of the attribute. Can this account of Aristotle's meaning be attributed to Alexander?

Aristotle begins Book II by distinguishing four objects of inquiry: the 'that it is' (τὸ ὅτι), the 'why it is' (τὸ διότι), 'if it is' (εἰ ἔστι), and 'what it is' (τί ἐστίν) (II 1, 89b24–25). Aristotle explains the inquiry into the fact by saying that in this case we are 'putting it into a number' (εἰς ἀριθμὸν θέντες); his example is the inquiry into whether or not the sun is eclipsed (89b25–26). The contrast is with inquiry into the being of a centaur or god (89b32). Does the linguistic complexity involved in how we speak of the first kind of object of inquiry reflect a metaphysical complexity, and if so, what is it? Is the second sort of inquiry restricted to metaphysical unities, such as substances?

We have direct evidence that Alexander is in agreement with most of the commentators that the 'if it is' question is not to be restricted to basic subjects or substances. Aristotle cryptically comments that we seek a middle term when we seek either the fact or whether something is, either without qualification (ἀπλῶς) or partially (ἐπὶ μέρους) (89b39). Eustratius tells us that Alexander interpreted the problem of whether something is partially as concerning a predication. Alexander presents as an example the problem concerning the being of an attribute (πάθος), that is, into whether an attribute belongs to a subject. His example is our familiar one of whether the moon undergoes eclipse (εἰ ἡ σελήνη ἐκλείπει).²⁷ The inquiry into whether a lunar eclipse exists will be followed by an inquiry into why the moon suffers eclipse. This inquiry is resolved by discovering the middle of the demonstration that the moon suffers eclipse.

In his commentary on the *Topics*, Alexander discusses just this demonstration. He presents it as an example of the canonical, explanatory variety of demonstration, as opposed to the sort of demonstration which shows that the cause or explanation follows the effect, a mere dialectical syllogism.

²⁶ On this passage, see Moraux (1979), 104–109.

²⁷ Eustratius *In APo.*, 18.32–19.4, on which see Moraux (1979), 88–89.

(T4) [S]omeone who proves (δεικνύς) that the moon is eclipsed because it is screened by the earth offers a demonstrative proof, e.g.

The moon is screened or obscured by the earth.

What is screened or obscured by the earth suffers an eclipse,

for what gives the cause of the eclipse is the screening. But if someone proves that the moon is screened by the earth because it is eclipsed, he does not offer a demonstration in the strict sense even though what he obtains is true, since he is not proving in the strict sense what is posterior and caused through what is primary and gives the cause, but what is prior through what is posterior, for the eclipse is posterior to the screening and results from it.²⁸ (16.9–16)

Alexander here refers to Aristotle's own example of the 'demonstration of a definition' at *APo.* II 8, 93a30–33. There are questions concerning the status of both premises here. Are they themselves demonstrable? If so, how? In II 8 itself Aristotle directs our attention to the minor premise 'what is screened or obscured by the earth suffers an eclipse', for it is this premise that makes the connection between the cause of the eclipse and the eclipse. One who does not know what the cause of the eclipse is will not accept the premise, and the demonstration will fail to explain. Accordingly, a demonstration is required that connects the cause of the eclipse with whatever features one employs to identify an occurrence of an eclipse. Aristotle's example of this is the demonstration that connects the cause of the eclipse with 'failure to produce shadows even though the moon is full' (92b37–38). If one accepts that this failure is to be identified with the eclipse and demonstrates that the causal account of the eclipse (being screened or obscured by the earth) entails this failure, she is able to produce a demonstration showing why those features that she employs to identify an eclipse are in fact instantiated.

The provisional understanding of the attribute will be expressed in a nominal definition of the attribute.²⁹ It must be granted though, that we have no direct evidence that Alexander made this connection.³⁰ Both

²⁸ The translation is from Van Ophuijsen (2001), 18.

²⁹ See n. 16, above.

³⁰ Note however the scholiast to 94a14–15, discussed below, which, on Moraux's plausible reconstruction, takes Alexander to recognize that one can interpret Aristotle's assertion that in some cases there can be a demonstration of a definition as meaning that the conclusion of such a demonstration, such as 'the moon has light blocked from it,' is itself a kind of definition. This is evidence that Alexander took the provisional understanding of an attribute to be expressed in some form of definition. The scholiast does not explicitly identify such a definition as a nominal definition, but a nominal definition is the only sort of definition discussed in II 10 that would apply here.

Eustratius (121.32–122.20) and the Anonymous Commentator (563.21–28) take the provisional middle term to express one's provisional understanding of the attribute in question, but do not relate this to the expression of a provisional understanding that is the nominal definition.

4) On the line of interpretation I attribute to Alexander, the demonstration of the inherence of an attribute that has a cause other than itself is made possible through showing how it results from a juxtaposition or concatenation of basic subjects. This allows for the generation of a middle term (such as 'having its light blocked by the interposition of the earth') which is not going to be present in the definition of a single subject.

We know that Alexander faced the question of the status of the middle terms of a demonstration of a proposition like 'the moon is eclipsed.' At 93b12–14, Aristotle writes 'if there should be yet another middle for [or, besides] this, it would be from the remaining accounts' (ἀν δὲ πάλιν τούτου ἄλλο μέσον ἢ, ἐκ τῶν παραλοίπων ἔσται λόγων). Two major interpretations of this line have been proposed. As we shall see, Philoponus(?) understands this as discussing the relations among a number of partial definitions of the predicate term, an interpretation that does not take Aristotle to here consider the puzzle of how the sort of definition being discussed is grounded in unmediated premises. Eustratius tells us that Alexander presents a different interpretation: that the demonstration in question needs to have all of its premises in turn demonstrated on the basis of immediate premises, through filling in all of the required middle terms.³¹ This evidence does not speak to the question of the source or nature of these additional middle terms. But we see that unlike Philoponus(?), Alexander is here attending to the thorny question of the syllogistic structure of the demonstration in question when, according to a superficial reading of the text, Aristotle's concern is only to determine the sense in which a definition can be demonstrated.³²

³¹ Eustratius, 124.30–125.32, see also the *Anonymous Commentary*, 564.16–565.2; on these passages see Moraux (1979), 48.

³² Eustratius presents the following example of filling in the required middle terms. We demonstrate that all human beings are substances through the middle term 'animal'. But 'human beings are animals' is to be demonstrated on the basis of a middle term that will be the definition of animal (living sensing substance) and 'all animals are substances' is to be demonstrated on the basis of the middle term 'that which is in turn receptive of contraries'. (124.28–125.8) The example tells against the attribution to Alexander of my line of interpretation. For it is intended to illustrate the sort of demonstration that Aristotle is discussing in II 8, yet it concerns the demonstration of a definition of a substance. Further, only one substance is at issue, not a concatenation of basic subjects. To this, three

A text preserved by a scholiast which Moraux convincingly argues derives from Alexander³³ is evidence that Alexander took the things that have a cause other than themselves to be juxtapositions or concatenations of simple entities. Here the distinction between the *kath' hauta* things, in regard to which there can be no demonstration of the essence, and the things that are not *kath' hauta*, in regard to which there can, is said to be the distinction between simples and complexes. We can readily understand why the *kath' hauta* are simples. They are *kath' hauta*₃, the basic subjects, considered in isolation from other basic subjects. But why are demonstrated attributes complexes? I can think of no alternative to the interpretation that I proffer, and conclude that Alexander was thinking along similar lines.

5) What evidence is there of how Alexander took the demonstration of the inherence of a non-definitional attribute to serve as a 'demonstration of the definition'?

A scholiast on 94a14–16 presents Alexander's interpretation. The first part of the scholiast reports Alexander's take on Aristotle's final judgment on the sense in which there is a demonstration of a definition and the sense in which there is not.

points can be made. First, as we have seen, Eustratius makes clear in his introduction to his commentary on 93b12ff. that although in his exposition of II 8 he is in the main following Alexander, he adds his own points. So the example given may well be that of Eustratius, and this is indeed the opinion of Moraux (1979), 97. Second, the example ill suits the point Alexander is making, since 'human beings are animals' and 'animals are substances' ought to be recognized as unmediated propositions. Eustratius is a derivative and often confused thinker, more likely to make such an error than Alexander. Third, on Eustratius' own testimony, the sort of demonstration under discussion here is possible only in the case of those beings that have a cause other than themselves. It is hard to see what Eustratius or Alexander might mean in saying that human beings have causes other than themselves. If he takes it to mean that a human being is in some sense caused by human matter (cf. *Met.* VII 17, 1041b6–9) then it is not clear why the material instantiation of human is relevant in allowing us to 'demonstrate' that a human being is an animal, which is the intended point of the example at hand. I conclude that here, as elsewhere, Eustratius is seriously confused. As further evidence of this, consider Eustratius 126.17–24 (Moraux 1979, 107–109) where Eustratius himself explicitly attributes to Alexander the following example of a case of a demonstration of a definition which is illicit because it concerns a definiendum that does not have a cause other than itself: S 'human being', M 'living sensing thing', P 'animal'. 'Living sensing thing' is a plausible candidate for the definition of 'animal'. So Eustratius' example here of a subject for which the 'demonstration of a definition' is possible is precisely the same as his example elsewhere of the sort of case in which it is not!

³³ Moraux (1979), 7–8.

(T5) By Alexander: he says that it has become clear from the things that have been shown both the sense in which there is demonstration of the what it is and the sense in which there is not. There will be in this sense: that it is taken (*λαμβάνεται*) in demonstration. There will not in this sense: that there is a demonstration *of* it. Alternatively, there is a demonstration of the definition in the sense that it is of the definition of conclusion, but there is not in the sense that it is of definition as of a demonstration.³⁴

Alexander presents two interpretations of Aristotle's statement.³⁵ On both accounts, when saying that there is an *ἀπόδειξις τοῦ τί ἐστι* one employs the objective genitive; the essence is what is revealed or demonstrated. Only on the second interpretation is the demonstration *of* a definition, in the usual sense according to which the genitive governed by *ἀπόδειξις* refers to the conclusion.³⁶ The most straightforward way of understanding this is to take Alexander to allude to how the demonstration in question has as its conclusion a nominal definition of the kind under consideration. On the first interpretation, the definition is 'demonstrated' in a looser, non-technical sense of *ἀποδείξει*, according to which the demonstration reveals or shows the whole scientifically adequate definition. It does so insofar as the definition in question is assumed or taken (*λαμβάνεται*) in the demonstration. This could mean that the definition in question is assumed as a premise. Thus Moraux understands the scholiast as anticipating the interpretation (discussed below) found in Philoponus(?), to the effect that the 'material definition' is assumed in the demonstration of the formal definition. But the scholiast does not go so far as to say this, and such a move is absent from the Anonymous Commentator and Themistius. A more conservative interpretation has the scholiast, and hence Alexander, say that the demonstration in question contains the content of the definition in question; the definition is grasped (*λαμβάνεται*) in the process of demonstrating the conclusion.

³⁴ I follow the reconstruction in Moraux (1979), 111–113, 51A; see also Wallies (1883), xxi.

³⁵ Eustratius (134.1–6) gives only the first of the two options, the Anonymous Commentary (567.27–29) probably more accurately reflecting the commentary of Alexander, gives both. See Moraux (1979), 113.

³⁶ I omit consideration of the phrase that follows, *τοῦ δ' ὡς ἀποδείξεως οὐκ ἔστι*, which I find unintelligible. The text here is clearly corrupt; that the same incomprehensible wording is found in the Anonymous Commentator shows that the corruption predates the writing of the scholiast. On this see Moraux (1979), 112–113.

So even if the evidence on Alexander's thoughts on the sense in which there could be a demonstration of an essence does not conclusively show that he anticipated the interpretation I advocate, it is not inconsistent with that account.

There is one more crucial piece of evidence on Alexander's views on the structure of demonstration. A passage to which we have already glanced, from his commentary on *Topics* 1, discusses Aristotle's distinction of a demonstration from a dialectical syllogism on the basis of the nature of their premises (those of a dialectical syllogism are commonly accepted, those of a demonstration are true and primary).

Alexander explains that for demonstrative premises to be primary, the facts that they express must be prior in the order of explanation to the conclusions that are demonstrated on their basis. A syllogism that deduces the primary premise on the basis of a true proposition that is its effect (what *APo.* I 13, 78a36–37 calls a syllogism of the fact) is not a demonstration in the strict sense. Significantly, Alexander's first example is not Aristotle's own (proving that the planets are near on the basis of their not twinkling, as opposed to demonstrating that they do not twinkle, on the basis of the fact that they are near) but is the familiar example of II 8, that of the lunar eclipse: the true demonstration is not the syllogism that deduces that the sun's light is screened or obscured on the basis of the eclipse, but that which shows how the moon's eclipsing follows from its being screened or obscured (*in Top.* 15.24–16.8).

Only the true demonstration, the second, would have premises that are primary. Alexander tells us that this means that, at some level of analysis, its premises will be immediate (*in Top.* 16.6–8; cf. 17.16–24). Left unexplored are the questions of the source and syntactic form of these immediate premises (questions that are especially acute in the case of the demonstration of the lunar eclipse). Hence Alexander does not discuss the key role that definitional premises play in demonstration, and does not here face the question of how definitions can provide all of the premises required for demonstrations with any real explanatory power.

Alexander does present another example of a chain of demonstrative syllogisms that sheds some light on his views of the ultimate syllogistic structure of demonstration. The purported demonstration deals with Aristotle's metaphysics of composite substance (a topic not broached in the *Posterior Analytics* itself). The demonstration is:

- a) Of each of the things that are, the form is that according to which it is.
- b) The living being consists in these (i.e. form and matter)].

Therefore: c) The form of a living being is that according to which it is alive.

Also: d) The living being is sensitive by virtue of its soul.

e) A living being is alive by virtue of that by which it is sensitive.

Therefore: f) A living being is a living being by virtue of its soul.³⁷

From these it can be deduced through two first figure universal syllogisms that

g) the soul is the form of a living being.

Given a new premise h:

h) the form of the living being is invested (?) in matter,³⁸

and g; we deduce that:

i) the soul is enmattered.

Likewise given premise j:

j) the enmattered form is inseparable,

we demonstrate k) soul is inseparable from matter.

(16.31–17.4)

None of the ultimate premises here are definitional. Premise a could be taken to be definitional, but we are told that it is ‘provided a foundation by induction’ (δι’ ἐπαγωγῆς συνίσταται; 17.2–3),³⁹ connected in some unspecified way (which is not demonstration) with the supposition (κείμενος) that all that is in actuality consists in form and matter. Note that we have a multiplicity of terms (form, matter, actuality, being) that are taken to stand in certain relations, and that these relations are basic and primary, arrived at through induction. It is on the basis of these relations that we can generate a premise that allows us to explain the inherence of predicates that are not *kath’ hauto*₁ in respect to their subjects.

These are strong indications that for Alexander, a demonstration of a non-definitional predication (what ‘has a cause other than itself’) is made possible through some relationship or co-instantiation posited among basic kinds. Not discussed are the nature of such relationships, and the nature of the principles in which they are expressed.

Admittedly, there are problems with the series of syllogisms that Alexander lays out for us. For example, we might question why premise e is primary. Alexander tells us that it is an evident proposition (ἐναργής

³⁷ There are difficulties putting this inference into syllogistic form, which I gloss over, as irrelevant to the issues of the order of priority of premises, which are here at issue.

³⁸ I here ignore the textual difficulty, which is irrelevant to our concerns.

³⁹ Van Ophuijsen (2001), 19.

πρώταις; 17.6–7), but this premise can be demonstrated on the basis of the definition of an animal and the definition of soul that is being ‘demonstrated’. Alexander’s claim that the chain of syllogisms that he puts forward will work as a real demonstration is indefensible. But we note that premise e (according to which a living thing lives by virtue of that by which it senses) reflects a pre-theoretical understanding of the cause of life, just as a nominal definition reflects a pre-theoretical understanding of the definiendum. As in the case of the demonstration that the moon suffers eclipse, the use of such a premise does not void the demonstrative character of the syllogism. In neither case does it render the syllogism merely dialectical. This is because, just as a nominal definition accurately expresses the meaning of a word, as actually employed, premise e accurately expresses what is meant when one refers to the cause of life (in an animal).

I have shown how Eustratius, the Anonymous Commentary, and the scholiast provide evidence that Alexander took the account of the demonstration of a definition of II 8–10 to concern the structure of demonstration of a non-definitional attribute, that the cause of the attribute is expressed as a middle term of such a demonstration, that in some sense the conclusion of this demonstration is a definition, and that a full scientific demonstration is drawn not simply from the conclusion or the middle term, but is ‘taken’ from the demonstration as a whole. The present evidence leaves unclear exactly how a demonstrated attribute results from the basic subjects, although it points to the attribute being the result of a complex entity or concatenation of simple entities. The evidence is also unclear on what sort of definition has the place of the conclusion of the demonstration in question. There is no direct evidence here that Alexander anticipates my interpretation and takes an attribute to be a complex insofar as it arises from a concatenation or co-instantiation of more than one basic kind, nor that he anticipated Ross and me and took the conclusion of the kind in question to be a nominal definition. But in my view there is no other way to put together into a coherent whole the extant evidence of Alexander’s interpretation.

5

From the Alexandrian reading of *APo.* II 8–10 we turn to an alternative. This line of interpretation has its source in the commentary on *APo.* II that has come down to us under the name of Philoponus.

Philoponus(?) writes:

(T6) At this point he begins to consider how it is possible for a demonstration of definition to come about. For there to be a clearer interpretative account of the text at hand, we must consider in how many ways 'definition' is said. Now definition is either material, inasmuch as it is taken from the things that belong to matter, or it is formal, when it is taken from the things that essentially belong to the thing. A material definition either converts or does not convert, and is either the same as what is defined or is different. Now a material definition that converts and is the same as what is defined is 'a human being is an animal that walks upright, is flat-nailed, and is capable of laughter.' One that does not convert and is not the same as what is defined is 'anger is a boiling of the blood around the heart.' It is not the same as what is defined, since it does not convert. For if it converted, it would be the same. For every instance of anger is a boiling of the blood around the heart, but not every boiling of the blood around the heart is anger, for those who are feverish have blood boiling around the heart, but they are not angry. On the other hand, the formal definition either converts with and is the same as what is defined, as is the case with 'a human being is a mortal rational animal' (for it either has differentiae that are all essential and constitutive of form or has one of them that comes from the matter, such as 'mortal') or it does not convert and for this reason is not the same as what is defined, such as 'anger is a desire for revenge.' For every angry person is angry because of a desire for revenge, but not everyone who desires revenge is angry. For there are some people who mentally desire revenge on their, but are not angry; rather they are calm and collected and feign friendship. These, the material and formal definitions, are not definitions in the strict sense. Rather, they seem to be definitional, but are not. That is the reason why they do not have the property of definition, to convert with that which is defined and being the same as it. A definition in the strict sense for each thing is one, not many. (Since the formal definition is prior to the material definition, which is why those who are angry first desire revenge, and then accordingly boil the blood around the heart, and further, every demonstration comes from the things that are prior; the demonstration of the material definition must come about through the middle term of the formal definition like this: one who is angry desires revenge, but the one who desires revenge boils the blood around the heart, therefore the one who is angry boils the blood around the heart.) Definition in the strict sense comes from both, that is, it is made up of both matter and form (for example, anger is a boiling of blood around the heart that comes about from a desire for revenge) and there cannot be a demonstration of this.⁴⁰

(364.14–365.13)

Philoponus(?) takes the demonstration of an essence to be a matter of relating the definition that expresses the material component of the kind

⁴⁰ The translation is from Goldin (2009), 53, slightly modified.

with that which expresses the formal component of the kind. The analysis of nature and natural kinds in terms of matter and form is absent from the *Posterior Analytics*, as it is in all of those texts grouped together as the *Organon*. By one of his examples, Philoponus(?) shows that his analysis is rather suggested by a text outside of the *Posterior Analytics*, *De Anima* I 1 403a25–b19, which builds on and adapts Aristotle's theory of demonstration in light of his hylomorphic metaphysics. There, Aristotle considers the question of what would be the appropriate sort of definition to give for the passions of the soul. Because these passions have both a cognitive and bodily element, an adequate account of a passion needs to express both. Aristotle is willing to refer to an account of a passion that identifies only one or another as a definition. His primary example is again that of anger, which can be defined as a boiling of the blood around the heart or as a desire for retribution in return for pain. Aristotle makes clear that such definitions are incomplete. The fully adequate definition will express both aspects.

From this passage, Philoponus(?) learns that there are two different sorts of definitional accounts that play a role in a demonstration of the existence of that kind: definitions of a sort. One, like 'anger is a boiling of the blood ...' is material, the other, like 'anger is a desire for retribution ...' is formal. Among the commentators, the distinction between matter and form can indicate the distinction between what is indeterminate and what is determinate, just as much as it can indicate the distinction between the two different components of composite substance.⁴¹ I elsewhere argue that other texts strongly indicate that Philoponus(?) is understanding the distinction in the first manner.⁴² On Philoponus' understanding, the superficial characteristics of anger that are evident to others constitute the 'material definition' that remains indeterminate until it is supplemented by an account of the cause, which is different from those characteristics insofar as neither account necessarily converts with the other. Philoponus(?) is saying that, insofar as it can be shown that the material definition (normally) follows the formal definition, one both demonstrates the inherence of the material definition in some basic subject, via the middle term of the formal definition, and, in a sense, 'demonstrates' the material definition of the kind in question.

Philoponus(?) continues, presenting an account of 93a3–8, that fills in a number of gaps in the terse text before him:

⁴¹ See Fasso (2004), 10n.30.

⁴² See Goldin (2009), 160–2nn. 214 and 217.

(T7) Since to know the 'what it is' and to know the cause of the 'if it is' are the same things (for the 'what it is' is a definition, and the definition is a form, and the form is a cause), the 'what it is' is therefore a cause, for the definition reveals the cause of whether there is in reality the object of investigation or not. Let there be added to this 'he agrees that there comes about a demonstration of a definition.' The whole point is as follows: if the 'what it is' is a cause, it is possible for there to be a demonstration of the definition. The account and the cause of this, that there can be a demonstration of a definition, is that there is something, namely, a formal definition, which is taken as cause, in the middle. And this cause is either the same thing or something different, that is, it is either the same as the definiendum or is something else. And if it is something else, it is either demonstrable, as is the material definition, or is indemonstrable, as is the formal definition. For the material definition belongs to anger through the middle term of the formal definition, from which it is demonstrated. But the formal definition belongs immediately to anger.⁴³ (365.14–27)

As Philoponus(?) unpacks the demonstration here, however, the minor term is not one of the basic subjects of the sciences (the moon or the clouds), but is the definiendum itself.⁴⁴ The middle term is the form of the kind in question, and the major term is the kind as understood in its material aspect. (Thus, in the example of demonstrating the definition of anger, the material definition is said to belong to anger, not a human being, through the formal definition.) Philoponus(?) seems to envisage the demonstration discussed in *APo.* II 8 as follows:

The eclipse of x is the interposition of the earth between x and the sun,
 The interposition of the earth between x and the sun is a blocking of the
 sun's light from x,
 Therefore, the eclipse of x is a blocking of the sun's light from x,

where 'a blocking of the sun's light from x' is the material definition of the eclipse of x and 'the interposition of the earth between x and the sun' is the formal definition.

Recall that for Alexander, Aristotle's distinction between cases in which there cannot be a 'demonstration of the essence' and cases in which there can is a distinction between the kinds of things with which the demonstration is concerned. There can be a kind of demonstration of the essence of only 'that which has some other cause,' that is, of an attribute belonging to a substance. This is because the conclusion of such a demonstration is the predication of that attribute of some subject of the

⁴³ Goldin (2009), 53–54.

⁴⁴ This way of understanding Aristotle's demonstration of a definition is explored and contrasted with the alternative in Ackrill (1981), 359–363.

sciences, which is its cause, and, insofar as the attribute is not *kath' hauto*₁ of the subject, it is something different from it. But the conclusion of 'the demonstration of the essence', as Philoponus(?) conceives it, is the predication of a partial and indeterminate (material) definition of a subject. There is no reason why such a syllogism needs to be restricted to attributes as opposed to basic subjects.

So for Philoponus(?) the distinction at hand is not between two different kinds of things, but two different kinds of predications, found in the partial definitions that are related by the demonstration in question.

(T8) In the case of some things that are effects, the cause is different from the effect, for there are some causes which follow after certain prior principle causes that belong proximately to the effect. For example, the cause of the eclipse of the moon is the fact that the moon comes to be unilluminated, but it follows afterwards, for the blocking precedes it. For first the moon is blocked by the earth and is eclipsed; then, accordingly, being unilluminated follows it. Likewise in the case of thunder the noise that comes afterwards follows the quenching of fire that was previously occurring in the cloud. Now the blocking, which is the cause, is different from the effect, the eclipse of the moon, and the quenching of fire is different from thunder, and the boiling of the blood around the heart is different from anger. But some causes are not different from the effect but are the same, as are mortal rational animal and human being ... (A)ll of those definitions that immediately belong immediately to the things defined and are effects, as the blocking by the earth belongs immediately to the eclipse and the quenching of fire to thunder and the desire for revenge to anger, are principles which are indemonstrable and we hypothesize them and assume them as matters of agreement, and in these cases we do (not) investigate the if it is or the what it is. Such definitions are indemonstrable, for they do not occur as conclusions of a demonstration.⁴⁵

(371.4–25)

Even if a material definition converts with the definiendum (and we have seen Philoponus(?) take pains to point out that it does not always do so) it is not 'the same as it.' Likewise, a formal definition does not necessarily convert with the definiendum, yet Philoponus(?) takes it to be the same as it (and hence not such as can be the conclusion of a 'demonstration of a definition'). Philoponus(?)(?) tells us that the material definition is not the same as definiendum because it 'follows after it.' Such following is temporal in case of thunder, and, arguably, in the case of anger, but, accepting Aristotle's account of the propagation of light, as he does, it cannot be temporal in the case of the eclipse. The priority that

⁴⁵ Goldin (2009), 61.

Philoponus(?) has in mind is causal, rather than temporal.⁴⁶ The formal definitions express the structures or essences that constitute the kind; if the conditions laid out in the formal definition are satisfied, the kind in question exists. On the other hand, the material definition of a kind expresses certain characteristics of things, which are brought about by an external cause. (Presumably these bodily characteristic of things are what Aristotle would call ‘clearer to us’ since they are more readily available to perception. This is why, just as for Alexander the inquiry into the essence of a kind begins with a provisional understanding of that kind, which is expressed in a nominal definition, so, on this interpretation, the provisional definition with which the inquiry into an essence begins is a material definition. See 368.17–369.12.)

We see that questions of the structure of demonstration (which premises are mediated and which are immediate, and how exactly the mediated propositions are thought to be demonstrable) are not of particular concern to Philoponus(?). Instead, Philoponus(?) sees Aristotle as concerned with showing how demonstration can render explicit the relations holding between causal, determinate accounts, and indeterminate, provisional accounts of the kinds studied by the sciences. This is, I believe, a misreading of the text. First, the distinctions between potentiality and actuality, and matter and form, are absent from the *Posterior Analytics*, most likely postdating its writing.⁴⁷

Second, Philoponus(?)’ discussion of Aristotle’s example of the monad at 93b24, which on Alexander’s reading could be taken as the presentation of a case of that which has no other cause, is here not related to his commentary on II 8–9. Third, it is not at all clear how the ‘demonstration of a definition,’ as Philoponus(?) understands it, meets the formal requirements for demonstration, as laid out in *APo. I*; Alexander’s account can be interpreted as dealing with this very problem.

⁴⁶ Goldin (2009), 162–3n.220.

⁴⁷ De Rijk (2002), vol. 1, 699 takes the ὁρισμὸς ὑλικός of Philoponus(?) to an expression of the genus of the definiendum, insofar as the genus can be considered the matter of the essence. But such a reading cannot be given to 364.16–18: ὁ γοῦν ὁρισμὸς ἢ ὑλικός ἐστιν ὡς λαμβανόμενος ἐκ τῶν προσόντων τῇ ὕλῃ ἢ ἐδικός ὡς λαμβανόμενος ἐκ τῶν οὐσιωδῶς ὑπαρχόντων τῷ πράγματι. For a genus like a differentia belongs to a thing οὐσιωδῶς. What then is the contrast being made here between a material and a formal definition?

Yet the reading of Philoponus(?), like many found in the Hellenistic period, cast long philosophical shadows, which turn out to have philosophical importance. For, beginning with Grosseteste⁴⁸ and Aquinas,⁴⁹ the scholastic tradition tended to follow Philoponus(?) on their reading of II 8. It therefore never squarely faced the question of the nature of the immediate premises involved in a demonstration that explains natural phenomena. Eventually, this gap in Aristotelian science, so understood, became a matter of major concern, leading Ockham to posit many principles of demonstration to be indemonstrable principles grasped solely on the basis of experience of particulars, not the definition of the minor term,⁵⁰ an invitation to empiricism. But this story must wait for another occasion.

⁴⁸ Grosseteste (1981), 329–344. On the influence of Philoponus' commentary on Grosseteste, see Ebbesen (1990), 448–449.

⁴⁹ Aquinas (1955), Book 2, Lectures 7 and 8, translated in Aquinas (1970), 187–196. Representative 20th century interpretations that follow Philoponus(?) are Tricot (1962), 187–197, Mansion (1976), and De Rijk (2002), vol. 1, 653–704.

⁵⁰ See Longeway (2005).

ARISTOTLE AND PHILOPONUS ON FINAL CAUSES IN DEMONSTRATIONS IN *POSTERIOR ANALYTICS* II 11

MARISKA LEUNISSEN*

1. BACKGROUND: PHILOPONUS A NEOPLATONIST CRITIC OF ARISTOTLE

Philoponus, a philosopher, scientist and theologian of the 6th century AD, stands out from the Neoplatonist tradition in which he had been brought up by his critical approach towards the philosophers he was commenting on.

The composition of commentaries was the common way for philosophers in late antiquity to develop and communicate their ideas. The proper way of exegesis was to try to harmonise Plato and Aristotle and to defend their doctrines as much as possible. This apologetic method of exegesis was also practiced and pled for by Philoponus' contemporary and arch rival Simplicius; Philoponus himself, however, developed more and more into a critic of Aristotle.

In the early commentaries, that are professed to be based on lectures of Ammonius (who was Philoponus' teacher), such as *On Generation and Corruption*, *On the Soul*, *On the Prior Analytics* and *On the Posterior Analytics*, Philoponus' criticism remained fairly modest and consisted mostly of careful and quite common Neoplatonic reinterpretations of or additions to Aristotelian doctrine. In later commentaries such as *On the Physics* and *On the Meteorology*, on the other hand,

* This paper presents some of the preliminary results of my doctoral research into the structure, function, and explanatory force of teleological explanations in Aristotle and the ancient commentary tradition. I would like to thank Frans de Haas and the European Science Foundation for organising a stimulating conference, and for allowing me to participate. I am also grateful to the participants of the Leiden research seminar on the *Posterior Analytics*, Frans de Haas, Pieter Sjoerd Hasper and Marije Martijn for their invaluable assistance analysing *APo.* II 11; much of what will be presented in this paper is the result of the efforts of all four of us. Of course, the errors which remain are mine, and the views expressed are not necessarily shared by the other participants. [Postscript: My interpretation of the structure of teleological explanations in Aristotle's *Posterior Analytics* II 11 has since appeared as Leunissen (2007).]

Philoponus became more critical. The modification or even outright rejection of Aristotelian-Neoplatonic ideas and doctrines became a common procedure. As these later commentaries give more room to Philoponus' own views, they are generally considered to be based on courses Philoponus was teaching himself. Especially Philoponus' polemical comments and empirical approach in the field of natural philosophy have made him famous. Among his many innovations, his rejection of Aristotelian dynamics and its replacement by a novel theory of impetus is celebrated as one of his most important achievements. For present purposes, I will leave out a discussion of Philoponus' later theological treatises that also contain much Aristotelian philosophy and some criticism thereof, but this time from a predominantly Christian point of view.

Regarding the use and function of final causes and teleology in Aristotle's natural philosophy, doctrinal criticism by Philoponus can be found in, for example, his commentary *On the Physics*,¹ where Philoponus seems to replace, or at least to enlarge Aristotle's theory of teleology of natural place with a theory that ascribes internal force and self-agency to the simple elements.² The same commentary displays also some methodological criticism regarding final causes in that Philoponus at one point³ criticises Aristotle over one of his proofs of the purposiveness of nature. This methodological criticism has some doctrinal implications as well, as it leads Philoponus to disagree with Aristotle about the analogy between art and nature with regard to teleological production. The type of criticism Philoponus passes on Aristotle regarding the use and function of final causes in demonstrations in his commentary on the *Posterior Analytics*, is in a way comparable to the latter, that is, to methodological criticism with doctrinal implications.⁴

¹ *In Phys.* 581.8–31; 632.25–30.

² On Philoponus' abandonment of teleology of natural place, see especially McGuire (1985), and Wolff (1987), but cf. Sorabji (1987), 17–18 and (1988), 244–246 for a more moderate view.

³ *In Phys.* 310.5 ff.

⁴ I take Philoponus to be the author of the commentary on *Posterior Analytics* II under discussion; for the question of authorship, see Goldin's contribution in this volume, note 1.

2. INTRODUCTION OF THE SUBJECT AND THE PURPOSE OF THIS PAPER

In his commentary on *Posterior Analytics* II 11, Philoponus does not criticise Aristotle on doctrinal grounds, but complains about the way Aristotle has set out the examples of syllogisms that are supposed to pick out final causes as the middle term. As I hope to make clear in this paper, this apparent innocent ‘methodological’ correction of Aristotle by Philoponus has had great doctrinal importance for our modern understanding of Aristotle. By correcting Aristotle on the use and function of final causes in demonstrations, Philoponus, and probably also his predecessors whose accounts on this subject have been lost, are in fact misrepresenting Aristotle in a way that might have misled modern interpreters of the *Posterior Analytics* who are still following his interpretation. The main purpose of this paper is to trace back the ‘traditional interpretation’ of *Posterior Analytics* II 11 to Philoponus, and to show why it is mistaken.

By way of a preliminary, I will first offer a general outline of *APo.* II 11 and of the example on demonstrations involving final causes, and discuss briefly its most important interpretational problem. Next, I will analyse Philoponus’ solutions to this problem and show why his criticism of Aristotle is out of place. I conclude by offering some suggestions for an alternative reading of Aristotle’s text.⁵ The appendix contains a translation of Philoponus’ *On Aristotle Posterior Analytics* II 11, 94b8–22, 378.1–380.3.

3. GENERAL OUTLINE OF *APo.* II 11

In *APo.* I 2, Aristotle argues that scientific knowledge, expressed in syllogistic form, ultimately consists in knowledge of the explanation of why things are the case (see especially *APo.* I 2, 71b9–13). In *APo.* II 11, Aristotle specifies this assertion by introducing a ‘doctrine’ of four causes or explanations (*aitiai*) which are all to be demonstrated through the middle term. (*APo.* II 11, 94a20–27):

(T1) Since we think we have ⟨scientific⟩ knowledge (*epistēmē*) when we know the explanation (*aitia*), and there are four types of explanation (*aitiai*)—one, what it is to be a thing, and another, given what things being

⁵ These suggestions are developed further in Leunissen (2007).

the case it is necessary for that to hold; another, what first initiated the motion; and fourth, the for the sake of what—all of them are brought out (*deiknuntai*) through the middle term (*to meson*).

The traditional reading of this opening statement—which as I will show below, goes back directly to Philoponus—is that all four Aristotelian causes can or must be picked out as middle terms in scientific demonstrations. Indeed, after this introduction of the subject matter, Aristotle continues by providing three examples of demonstrations, all involving different types of causality.

The first example of a demonstration involving material causation is developed in the context of a discussion of the necessary nature of demonstrative syllogisms, and pertains to the geometrical question of why the angle in a semicircle is a right angle (94a27–35; the example resembles a proof found in Euclides, *Elements* III 31). In formalising the syllogism, Aristotle introduces ‘half of two rights’ as the explanatory middle term. Aristotle does not offer a separate example for formal explanation, but instead seems to refer to earlier chapters where such demonstrations have been offered (94a35–36; see perhaps *APo.* II 8, 93b8–13). For an example of a demonstration involving efficient causation, Aristotle draws from local history (94a36–b8): the explanation of why the Persian war came upon the Athenians is demonstrated through the explanatory middle term of the Athenians being the first to attack. The last example (in 94b8–b26) pertains to demonstrations involving final causes, and contains a relatively long and complicated formalisation of walking after dinner being for the sake of health. As the explanatory middle term, Aristotle picks out the food not floating at the surface of the stomach. As Philoponus’ criticisms mainly apply to this last example, I will present a more detailed account of it.

Aristotle opens the section on demonstrations involving final causes by introducing two parallel examples of things that are for the sake of something else (*APo.* II 11, 94b8–11):

(T₂) Regarding the cases in which the causal relation (*aition*) is that something is for the sake of something (*to heneka tinos*)—for example: ‘For what reason does he walk? In order to be healthy.’ ‘For what reason is there a house? In order to protect the possessions.’ In the one case it is in order to be healthy, in the other in order to protect.

Aristotle indicates that in these cases a ‘for the sake of what’ question equals a ‘because of what’ question (*APo.* II 11, 94b11–12):

(T3) There is no difference between for what reason it is necessary to walk after dinner and for the sake of what it is necessary.

Next, Aristotle formalises the second of the two examples (*APo.* II 11, 94b12–14):

(T4) Call ‘walking after dinner’ C, ‘the food not floating on the surface’ B, and ‘being healthy’ A.

He then asks his readers to suppose the following (*APo.* II 11, 94b14–16):

(T5) Suppose, then, that to make the food not floating on the surface at the mouth of the stomach ⟨B⟩ holds of walking after dinner ⟨C⟩, and suppose the first ⟨B⟩ is healthy ⟨A⟩.

In these lines Aristotle characterises walking as a health-producing activity, thereby implying that walking is an efficient cause of health (cf. *EE.* I 8, 1218b16–22; *Rh.* I 6, 1362a31–34; and *Ph.* II 3, 195a8–11). According to Aristotle this supposition is based on an opinion, or rather, on an observed relation (*APo.* II 11, 94b16–18):

(T6) For it is thought that B, the food not floating on the surface, holds of walking, of C, and that thereof (of B) A, healthy, holds.

Apparently, it is because walking brings about a specific physiological condition in the body that is healthy that the activity of walking can be qualified as health-producing. This exhibits the explanatory role of B, of the food not floating on the surface. Indeed, Aristotle inquires next into the middle term which causally connects A and C (*APo.* II 11, 94b18–20):

(T7) What, then, is the causal factor (*aition*) for C of A’s—the for the sake of which⁶—holding of it? B, the not floating. This ⟨B⟩ is like a definition of it ⟨of A⟩; for A will here be explained in this way.

The not floating of food is like a definition of being healthy in the sense that it shows how being healthy in this context (i.e. in the context of a person who has just had dinner) is to be understood. The remaining question pertains to the relation of B and C (*APo.* II 11, 94b20–21):

(T8) And for what reason does B hold of C? Because that is what it is to be healthy: to be in such state.

Here Aristotle suggests that we have touched upon a premise that is not further analysable but is immediate. The section is then rounded off by an enigmatic advice to his readers (*APo.* II 11, 94b21–22):

⁶ The apposition ‘the for the sake of which’ belongs to A, not to the *aition*, which is itself for the sake of something.

(T9) Surely on must change (*metalambanein*) the *logoi*, and in that way each of them will become clearer.

The remaining part of the section consists in a short remark about the order of the terms in two types of explanations (*APo.* II 11, 94b23–26):

(T10) Here the events occur in the opposite order from the cases where the causes are according to motion. For in the latter the middle term must occur first, while here C, the ultimate term, [must occur first] and last the for the sake of which.

The chapter concludes with a digression about the possibility of things occurring for a purpose and from necessity at the same time (*APo.* II 11, 94b27–95a9).

In contrast to the apparent clarity of structure and argument in this chapter, its content has raised many interpretative problems for modern scholars of Aristotle, most of which pertain to the general purpose of the chapter and to the nature of the individual syllogistic examples. One problem that concerns all the examples given is, for instance, that none of the syllogisms posited constitute typical Barbara-demonstrations (which is the prescribed mood for science), where the predicate holds universally and necessarily of the subject.⁷ However, in particular the section dealing with demonstrations involving final causes is notorious under the traditional interpretation, because in the example Aristotle offers the final cause is not picked out by the middle term, but by the major or predicate term.⁸ For instance, in the modern commentaries on the *Posterior Analytics*, one finds Ross stating that Aristotle wrongfully claims that final explanations can be put into syllogistic form with the final cause as middle term, since that is “in fact impossible”.⁹ Barnes calls the section “miserably obscure”,¹⁰ while Detel refers to the example

⁷ Cf. Barnes (1993), 228 and Ross (1949), 647.

⁸ See Barnes (1993), 229ff.; Detel (1993), 707ff. and Ross (1949), 642–643. The problem is expressed most emphatically in Detel (1997), 65–66: “The syllogistic reconstruction of the first of these [two teleological] examples Aristotle seems to offer in the subsequent passage (94b12–20) turns out to be, at first sight, extremely problematic, though, since he represents the aim of being healthy, not by the middle term, B, but by the major term, A. This is *clearly incompatible* with his general claim, expressed in 94a20–24, that the aim too must be proved through the middle term” (the italics are mine). Cf. also Ross’s paraphrase of 94a23–24: “and in every case the cause can appear as middle term in a syllogism that explains the effect”.

⁹ Ross (1949), 642.

¹⁰ Barnes (1993), 225. Cf. *ibidem*, 229.

in terms of it containing “*die größten formalen und inhaltlichen Rätsel*” and of it being “*extrem problematisch*”.¹¹ Aristotle’s own suggestion to *metalambanein tous logous* (“to change the *logoi*”) which should make things clearer, turns out to be equally obscure (Barnes calls it a “Delphic injunction”), since it is not immediately clear what those *logoi* are, or what the verb *metalambanein* means.

As we will see in more detail in the next section, Philoponus offers a very simple solution to the first problem, while providing an interesting suggestion concerning the second. According to Philoponus, Aristotle’s syllogism is set out in a confused way, and this legitimises the introduction of other—self-constructed—syllogisms that do pick out final causes as the middle term. Aristotle’s advice to ‘*metalambanein tous logous*’, is thus to be taken as an indication that Aristotle had realised himself that his ‘real’ example was hidden in the text, and that this example should be ‘taken separately’ from the example that is formalised explicitly in the text, but is wrong. In this way, Philoponus sets a trend of doing away with Aristotle’s actual example, and of providing other examples that exhibit final causes being picked out by the middle term instead.

4. PHILOPONUS’ CRITICISM OF ARISTOTLE’S EXAMPLES OF A DEMONSTRATION INVOLVING FINAL CAUSALITY

Philoponus starts his comments on the *Posterior Analytics* section on demonstrations involving final causes in II 11 in his usual manner of partly repeating and partly paraphrasing Aristotle’s account. He then explicates how the non-floating of food contributes to health by drawing from contemporary medical theory: it is only within the stomach that food is concocted into nourishment for the whole body; when it remains at the mouth of the stomach for too long it goes bad, produces an awful smell, and causes people to fall sick. Walking after dinner makes the food sink, and thus contributes to health. At the end of his first preliminary exposition, we find Philoponus’ first critical remark regarding Aristotle’s example (*In APo.* 378.16–19):

(T11) But since the syllogism is set out in a somewhat confused way by Aristotle, come on, let us make it clearer, to prevent that we discover something hard and arduous in the exegesis at hand.

¹¹ Detel (1993), 695 and 707.

Like many modern commentators, Philoponus judges the example to be vague, and seems to imply that Aristotle must have been confused when he set out the syllogism. In what sense Philoponus thinks the syllogism is confused, becomes clear from his own version of the syllogism illustrating demonstrations involving final causes presented in the next sentences (*In APo.* 378.19–21):

(T12) Possessions need protection: what is in need of protection, is in want of shelter. Possession thus needs shelter, i.e., they need the house. The minor term is the possessions, the major the want of shelter. And again, Socrates needs being healthy: who is in need of being healthy, needs to walk after dinner. To Socrates thus belongs the walking after dinner.

Treating the examples of the presence of a house and of the occurrence of walking after dinner in parallel—and by suggesting that these are syllogistic examples—Philoponus introduces in both cases a subject in need for something, which is picked out as the minor term in the syllogism (see table 1 below).¹² More important for our present investigation is that in both the examples Philoponus manoeuvres the final cause into the position of the middle term.

Table 1: Philoponus formalisation of demonstrations involving final causes

		Example 1	Example 2
A	Major term	House	Walking after dinner
B	Middle term <i>Picking out the final cause</i>	Protection	Being healthy
C	Minor term	Possessions (in need of protection)	Socrates (in need of being healthy)

Philoponus highlights his ‘correction’ or ‘elucidation’ explicitly in the next lines (*In APo.* 378.21–22):

(T13) Observe that in a way also in the case of this syllogism the middle term is the final cause, i.e. health, and in the case of the earlier syllogism, the middle term is protection.

According to Philoponus, the syllogism demonstrating why one walks after dinner runs as follows:

¹² This translation of final causality into ‘intentional’ terms of need or want requires further research, as it might be of grammatical interest. It could be an early sign of Philoponus’ replacement of final causality with a theory of internal force or self-agency.

Major premise: A (walking after dinner) holds of B (being healthy)

Minor premise: B (being healthy) holds of C (Socrates, who is in need of being healthy)

Conclusion: A (walking after dinner) holds of C (Socrates).

By turning Aristotle's introductory remarks into syllogistic form, Philoponus suggests that these are the actual or 'real' examples provided by Aristotle. The example Aristotle formalises himself explicitly in the text, on the other hand, is disqualified by Philoponus as 'a further syllogism' (*prossullogizetai*) which serves a different purpose (*In APo.* 378.26–28):

(T14) Next he infers by another syllogism the major premise by exchanging the terms of the major premise and assuming as the major term being healthy and walking after dinner, C, as the minor term.

This further syllogism demonstrating the major premise of Philoponus' version of the supposed 'real' syllogism is constructed in the following way: first, Aristotle exchanged the terms of the major premise. This means that the terms in Philoponus' version of the major premise switch places: being healthy is now predicated of walking after dinner. Secondly, in this syllogism 'being healthy' is picked out by the major term, and 'walking' as the minor term. Philoponus justifies this exchange of terms by claiming that 'being healthy' and 'walking after dinner' are used synonymously by Aristotle, and that it therefore does not make a difference which one of the terms is taken as referring to an underlying subject or to what is predicated. Philoponus continues his explication of this further syllogism by stating that Aristotle took as a middle term B 'the food not floating on the surface', and then offers his own reconstruction of Aristotle's syllogistic inference (*In APo.* 378.32–379.1):

(T15) He (i.e. Aristotle) takes as middle term B, i.e. the food not floating on the surface at the mouth of the stomach. And he infers syllogistically as follows: the person who walks after dinner has the want for the food not floating on the surface at the mouth of the stomach. And who is in want for that, to him belongs being healthy.¹³

Philoponus' reconstruction has the following syllogistic form:

Major premise: A (being healthy) holds of B (person who wants the food not floating)

Minor premise: B (person who wants the food not floating) holds of C (person walking after dinner)

Conclusion: A (being healthy) holds of C (person walking after dinner).

¹³ Thus, formalised: B holds of C; A holds of B; (thus A holds of C).

Again, Philoponus introduces the notion of need or wanting into the syllogism in order to be able to make sense of Aristotle's example. Moreover, with regard to the major premise, Philoponus remarks that the middle term is not a teleological definition of the major term (but a formal definition). This shows that for Philoponus the example provided by Aristotle cannot count as a proper teleological demonstration, because the middle term does not pick out a final cause. Philoponus makes up for this flaw in Aristotle's account by claiming that Aristotle's example is 'just' a further syllogism, and not the 'real' syllogism showing how final causes are brought out through the middle term.

This interpretation finds support in the following passage in which Philoponus replies to a hypothetical opponent, who raises the difficulty that Aristotle should have shown that final causes are to be assumed as middle terms in demonstrations, whereas in the example in the text the final cause is picked out by the major term (*In APo.* 379.4–9):

(T16) Maybe someone will raise the difficulty that if being healthy is the final cause of the walking after dinner, than it is set before him (i.e. Aristotle) to show that also the final cause is taken as a middle term in the scientific demonstration, while there he took being healthy as the major term. And we say that that is the further syllogism of the major premise of the syllogism. The ['actual' or 'real'] syllogism contains 'being healthy' as the middle term.

Philoponus replies by disqualifying Aristotle's explicit example in favour of his own 'reconstruction' of a syllogism in which the middle term picks out health as a final cause.

In the same line of interpretation, Philoponus takes *metalambanein tous logous* to mean 'to take the syllogisms separately' (*In APo.* 379.33–380.3):

(T17) That is, the syllogisms. Since the syllogisms were set out in a confused way and the syllogism was not set out by itself, nor the further syllogism of the major premise was set out by itself, he (i.e. Aristotle) says: 'take them on separately, and in that way everything will become clear for you.'

Once you separate the 'real' syllogism from the 'further syllogism', everything will be clear.

Philoponus criticism of Aristotle's account for not having set out the syllogisms clearly enough is consistent with his interpretation of the purport of the chapter as a whole. According to Philoponus, *APo.* II 11 is about showing how each of the four causes is assumed as a middle term in scientific demonstrations. Philoponus expresses his interpretation of the

chapter several times in the commentary as, for example, in the following passage (*In APo.* 376.16–18):

(T18) After enumerating the four causes and saying that each of them is assumed as a middle term in a demonstration and showing this with regard to the formal cause, he now shows that also the other middle terms appear in demonstrations by the use of examples.¹⁴

Since Aristotle's example does not clearly exhibit the final cause being picked out by the middle term, this is an unclearness that must be corrected by his commentator, Philoponus. At this point, however, one might raise the question of how satisfactory Philoponus' version of a demonstration involving final causes actually is. Philoponus succeeds in formulating a syllogism in which 'being healthy' is picked out by the middle term, but it is not—and this is crucial—picked out as a proper final cause. Rather, being healthy functions as an efficient cause in the person who has a need for it, and it is this need that initiates the action of walking after dinner. Moreover, Philoponus introduces intentional language to teleological demonstrations in order to make the example work (the causal relation underlying the syllogism is of one person wanting something instead of something being for the sake of something else), and it is not clear that Aristotle would need (or want) that here.

The commentary tradition, however, does seem to have followed Philoponus: many commentators after him have attempted to provide their own versions of an example of a demonstration in which the final cause is picked out by the middle term, and they do so on the assumption that Aristotle claims that all the four causes should appear as middle terms in scientific demonstrations. However, since it is almost impossible to construct such a syllogism while remaining close to the Aristotelian original, the general verdict on this section of *APo.* II 11 has continuously been very negative.

5. ARISTOTLE ON FINAL CAUSES IN SCIENTIFIC DEMONSTRATIONS: TWO HYPOTHESES FOR A NEW READING OF *APo.* II 11

As influential as Philoponus' interpretation might have been, it has not yet provided us with a satisfactory reading of *APo.* II 11. It is my contention that Philoponus misinterpreted Aristotle and that a careful

¹⁴ Cf. *In APo.* 376.12–14; 376.31–34; 377.21–22 and 377.26–27.

reconsideration of *APo.* II 11—and especially of the section dealing with final causes in demonstrations—is required. In the remainder of this paper, I will present two hypotheses that in an elaborated form may add up to an alternative reading of the *APo.* II 11. In this way, I hope to clear the chapter of its most important interpretational problems. Since I cannot go into all the details here, I will focus again on the section on final causes.

In the first place, I submit that it is not Aristotle's example that is wrong or confused, but rather our interpretation of what Aristotle means by saying that "all the *aitiai* are brought out through the middle term." What is crucial for the understanding of this sentence is that within the context of the *Posterior Analytics* there is a semantic distinction between the term *aitia* (fem.; pl. *aitiai*) and the term *aition* (neut.; pl. *aitia*). Frede has argued that the two terms were used differently in the original legal context in which they arose: *to aition* designated the agent responsible for a state of affairs, while *hê aitia* designated the accusation.¹⁵ I believe this distinction between *aition* as cause and *aitia* as causal account or explanation has been preserved in Aristotle's *Posterior Analytics*.¹⁶ The term *aition* is used almost exclusively by Aristotle to refer to the explanatory role of the middle term: the middle term must pick out whatever fact or event is responsible for the connection of the two terms between which it mediates.¹⁷ The middle term exhibits the causal relation between the two terms it connects by picking out the cause of why the one extreme holds of the other. The *aition* is thus a cause, and the middle term must pick out a causal relation. The term *hê aitia* is used less frequently in the *Posterior Analytics*, and is usually part of the definition of scientific knowledge as being knowledge of *hai aitiai*.¹⁸ Other passages¹⁹ point out that Aristotle

¹⁵ Frede (1980), 222–223.

¹⁶ Outside the *Posterior Analytics*, there is little or no evidence that Aristotle endorsed this distinction. It therefore comes as no surprise that this distinction is neglected by the traditional interpreters of the *Posterior Analytics*; both terms are read indiscriminatively as referring to the 'Aristotelian four causes,' and are translated more or less randomly as cause, reason, or explanation.

¹⁷ See for instance *APo.* 89b37–90a9; cf. 89b15; 93a4–8; 95a10–12; 95a17; 98b17–99b13. If the deduction does *not* proceed through the *aition* but through the more familiar of the (non-explanatory) converting terms, that is, when the middle term does not pick out an *aition*, then the demonstration that follows is not a demonstration of the reason why, but a demonstration of the fact (78a27–29; 78b4; 78b12; 78b15; 78b24; 79a4).

¹⁸ See 71b9–13; 71b20–33; 71b30–31; 87b40; and 94a21–27.

¹⁹ See, for example, *APo.* I 13, 78b28–31; in this passage, Aristotle compares explanations in *Camestres* to explanations in which the middle terms are set too far away: "Explanations (*aitiai*) of this kind resemble *extravagant statements* (*tois kath' huperbolên*)

conceives of these *aitiai* as being larger linguistic or syllogistic formulas that state the reason why in answer to the question 'why' (*to dioti* or *to diati*).²⁰ At least within the *Posterior Analytics* it is thus implied that *hê aitia* itself is a kind of *logos* or *sylogismos* containing an explanatory middle term, where *to aition* is a subordinated element of *hê aitia*.

The claim that all of the *aitiai* are demonstrated through the middle term, does therefore not necessarily entail that all the four types of causes are to appear as middle terms in demonstrations. Following the distinction between *aitia* and *aition*, there might be a distinction between the type of causality expressed in the *explanation* of a state of affairs (i.e. the type of causality expressed by the whole demonstrative syllogism), and the type of causality expressed in the middle term that picks out the *explanans* of this state of affairs. The upshot of this distinction for Aristotle's theory of demonstration is that all the four types of explanations will be brought out through the middle term, but that the middle term itself will not have to refer to the corresponding cause in all four cases.

For the example on demonstrations involving final causes this means the following. The question of why one walks after dinner is answered through reference to its final cause: the final cause of health explains why one walks after dinner, and walking is properly speaking for the sake of health. This is a teleological explanation (i.e. the *aitia* at stake is a teleological one). However, in order for a demonstration to be complete, we need to know why health holds of walking, and this is where the explanatory middle term comes in: the middle term picks out the cause of why health holds of walking. In this case, the middle term is the food not floating on the surface of the stomach, which is the material cause of health. The teleological explanation of why one walks after dinner is thus demonstrated through the middle term which reveals the material cause of health holding of walking; the middle term shows why the teleological relation between the two states of affairs obtains. Aristotle's point is that it is only by setting out the whole syllogism and thereby expressing explicitly the cause of why the predicate holds of the subject term that we come to reach true understanding of a phenomenon.

eirêmenois), i.e. when you argue by setting the middle term too far away. Take for example, Anacharsis' [argument] that there are no flute-girls among the Scythes since there are no vines."

²⁰ These explanations are syllogisms stating or proving the reason why, i.e. syllogisms that pick out *to aition* through the middle term (cf. 78b12–34; the term *hê aitia* occurs in 78b24 and 78b28; 85b23–27 and 85b35–36). In 93b33 ("the explanation of the difficulty was stated earlier") *hê aitia* is used to refer to a non-syllogistic causal account.

In the second place, Aristotle's advice to *metalambanein tous logous* at the end of the section about final causes in demonstrations should not be taken as a clue that Aristotle himself seems to be aware of the fact that his syllogistic example is mistakingly lacking the final cause as a middle term, and that one should look for another example that does pick out a final cause as a middle term. Since I take Aristotle's syllogistic example to be fine, *metalambanein tous logous* must refer to a procedure Aristotle has applied himself in construing this example.

Possible interpretations of the expression might be found in the *Prior Analytics* or in the *Topics*, where the verb *metalambanein* is used as a technical term and means invariably 'to put in place of' or 'to substitute for'.²¹ This suggests that we should expect *metalambanein tous logous* to mean something like 'substituting the *logoi* (for something else)'. One possible interpretation²² is that the substitution concerns the formulations or wordings (*logoi*) of the terms. This reading is based on Aristotle's use of *metalambanein* in chapter 34 of the first book of the *Prior Analytics* (*Apr.* I 34, 48a1–27):

(T19) Mistakes frequently will happen because the terms in the premise have not been well set out, as, for example if A is health, B disease, C man. It is true to say that A cannot hold of any B (for health holds of no disease), and again that B holds of every C (for every man is capable of receiving a disease). It thus would seem to follow that health cannot hold of any man. The reason for this is that the terms are not set out well with regard to formulation, since if the terms for being in the conditions are substituted [for the terms for the conditions themselves], there will not be a deduction; for example, if instead of 'health' 'healthy' is posited, and instead of 'disease' 'diseased'. For it is not true to say that being healthy cannot hold of someone diseased. But if this is not assumed, there is no deduction, except in respect of possibility: and that is not impossible. For it is possible that health holds of no man. (...) It is evident then that in all these cases the fallacy results from the setting out of the terms; for if the terms for being in the conditions are substituted, there is no fallacy. Thus, it is clear that in such premises the term for being in the condition always needs to be substituted and posited instead of that of the condition itself.

²¹ Smith (1989), 137; 261. See *Apr.* I 39, 49b3–6 ("One also needs to substitute things which have the same value for one another—words in place of words, phrases in place of phrases—whether a word or a phrase, and always to take a word in place of a phrase; for the setting out of terms will be easier."); but also *Apr.* I 17, 37b15; *Apr.* I 20, 39a27; *Apr.* I 22, 40a34–35; *Apr.* I 23, 41a39; *Apr.* I 29, 45b12–20; *Apr.* I 38, 49b1–2; *Apr.* II 4, 56b7–8, and *Apr.* II 8, 59b1–11; *Top.* II 2, 110a4–9; *Top.* V 2, 130a29–b10; *Top.* VI 4, 142b3, *Top.* VI 9, 147b12–14, and *Top.* VI 11, 148b24–149a7 (passim).

²² This reading is suggested by Fortenbaugh (1966), 192.

In this passage, Aristotle deals with fallacies that occur when the terms of the syllogisms have not been set out well with regard to formulation (48a9: *kata tēn lexin*).²³ The problem is solved by substituting terms ‘for being in the conditions’, that is, adjectives such as ‘healthy’ (*hugiainon*) and ‘diseased’, in place of the terms for the conditions themselves, that is, nouns such as ‘health’ (*hugieia*) and ‘disease’. We might postulate that a similar kind of substitution of the formulation of the terms has taken place in *APo.* II 11: the terms indicating the conditions are substituted by terms indicating what is in the condition, or rather, by terms indicating what is productive of the condition (see table 2 below). For in the discussion of the syllogism, Aristotle at one point substitutes ‘healthy’ (A_2) for ‘being healthy’ (A_1), and ‘to make the food not floating’ (B_2) for ‘the food not floating’ (B_1). Through these substitutions A and B could be predicated of C (a term indicating an activity), and also the causal relations (in this case, both material causal and efficient causal ones) between the three terms would become more evident.

Table 2: The Original Formulations of the Terms and their Substitutions

A_1	Being healthy	<i>to hugiainein</i>	Condition (Final cause)
B_1	The food not floating	<i>to mê epipolazein ta sitia</i>	Condition (Material cause)
C	Walking after dinner	<i>peripatos apo deipnou</i>	Activity (Explanandum)
A_2	Healthy	<i>hugieinos</i>	Productive of condition
B_2	To make the food not floating	<i>to poiein mê epipolazein ta sitia</i>	Activity productive of condition

Another possible interpretation²⁴ is that the substitution concerns the replacement of words by their definitions. This is the stock use of the expression in the context of the *Topics*,²⁵ and accordingly, we should add ‘*anti onomatôn*’ in the passage in the *Posterior Analytics*. Under this interpretation, we need to replace the words set out in the syllogism—such as ‘walking’, or ‘being healthy’—by their definitions (perhaps just as Aristotle did himself), until we find the more familiar terms,²⁶ and in that way the predications will become more evident.

²³ There is an interesting parallel for this method of *metalepsis* in the ancient grammar tradition; see Sluiter (1990), 111 ff.

²⁴ I thank Pieter Sjoerd Hasper for this suggestion.

²⁵ See for instance *Top.* II 2, 110a4–9; *Top.* VI 9, 147b12–14; *Top.* VI 4, 142a34–b6; and *Top.* VI 11, 149a1–3.

²⁶ This type of substitution might be connected to the one Charles observes in the *Posterior Analytics* with regard to the example of thunder: in this example the predicative

The elliptical expression of *metalebanein tous logous* might not provide us with sufficient information to decide which of the two possible interpretations we should favor, but this problem need not concern us too much. Both uses seem to be at play in the *Posterior Analytics* context: Aristotle probably meant some technical procedure of substitution that he applied himself in discussing the example, through which the causal relations between the terms and the predications became more evident. There is no need to follow Philoponus' advice 'to take the syllogisms separately', for there is only one the syllogistic example that Aristotle gives, and under my interpretation, it illustrates how a teleological explanation is demonstrated through a middle term, which picks out a material cause.

6. CONCLUDING REMARKS

In many ways, Philoponus' critical and empirical attitude towards Aristotelian doctrine has cleared the way for more modern approaches in the field of natural philosophy and scientific method. The example of an apparently small 'methodological' correction of Aristotle by Philoponus I discussed above might have had a less favourable impact on the early development of science and its conceptual apparatus. In this case, the trend of increasingly systematising and formalising Aristotle, which was of course part of the larger neo-platonic tradition and not something solely to blame Philoponus for, turned the theory of the *Posterior Analytics* into a rigid piece of scientific regulation. For centuries, commentators on the *Posterior Analytics* have tried to rewrite and reinterpret the examples of *APo.* II 11 so as to make them fit the neo-platonic ideal of scientific demonstrations containing each of the four causes as the middle term.

These attempts are, as I hope to have made plausible in this paper, based on a misconception of what Aristotle is arguing for in the chapter. The central thesis of my proposed alternative reading of the chapter is to distinguish the type of explanation that needs to be demonstrated from the type of cause through which the demonstrated takes place, or in short, to distinguish the *aitia* from the *aition*. Setting aside the question of whether final causes can be picked out by the middle term in a teleological demonstration, there is no need to think that final

term 'thunder' is replaced by its nominal definition 'noise in the clouds', which both gives us more familiar terms and indicates how thunder is to be understood in the relevant syllogism. See Charles (1999), 240.

causes must be picked out by the middle term in such a demonstration. Furthermore, I propose that Aristotle's use of *metalambanein tous logous* in the *Prior Analytics* and *Topics* might apply to *APo.* II 11 as well: in that case, it refers to a procedure of substitution that elucidates the relations and predications between the three terms involved. The hypotheses need to be developed further, but just as Philoponus, I hope that ultimately they will take away some of the confusion in and about *APo.* II 11.

APPENDIX: TRANSLATION OF PHILOPONUS ON ARISTOTLE
POSTERIOR ANALYTICS II 11, 94B8–22, 378.1–380.3

94b8: "Regarding the cases in which the causal relation is that something is for the sake of something"

Among these things the cause is 'for the sake of something', that is, it is the final cause. 'Such are the things' is what he intends to say, because it is necessary to add 'such are the things' to the apodosis of the sentence. For example, for what reason does Socrates walk after dinner? In order to be healthy. That is the final cause. And for what reason is there a house? In order to protect the possessions, and that is precisely the final cause. For to ask for what reason it is necessary walking is the same as to state for what purpose is it necessary to walk, i.e. the search in that case is for the final cause. In general, a person who asks for the reason why, seeks the efficient cause or the material cause or another one. And in this case he seeks the final cause. First the food remains at the mouth of the stomach, i.e. at the opening, and because of that it is necessary to walk after dinner, in order to sink it down under the stomach. For in there [the food] is more thoroughly cooked and is thus turned into nutriment for the whole body. If it remains at the opening of the stomach for a long time, then it stays uncooked and it becomes macerated. From there originate also the foul smell from the openings of people, and the acid belching steaming like roast meat, and from there a man falls sick. But since the syllogism is set out in a somewhat confused way by Aristotle, come on, let us make it clearer, to prevent that we discover something hard and arduous in the exegesis at hand.

Possessions need protection: what is in need of protection, is in want of shelter. Possessions thus need shelter—that is, they need a house. The minor term is the possessions, the major the want of shelter. And again, Socrates needs being healthy: who is in need of being healthy, needs to walk after dinner. To Socrates thus belongs the walking after dinner.

Observe that in a way also in the case of this syllogism the middle term is the final cause, i.e. health, and in the case of the earlier syllogism the middle term is protection. Next he infers by another syllogism the major premise by exchanging the terms of the major premise and assuming as the major term being healthy, and walking after dinner, C, as the minor term. He changed the terms by using them synonymously. Because 'walking after dinner' and 'being healthy' is the same, just as in the case of 'being able to laugh' and 'man'. Since they are considered as synonymous, it makes no difference to take whichever one of them as the underlying subject or as what is predicated. He (i.e. Aristotle) takes as middle term B, i.e. 'the food not floating on the surface at the mouth of the stomach.' And he infers syllogistically as follows: the person who walks after dinner has the want for the food not floating on the surface at the mouth of the stomach. And who is in want for that, to him belongs being healthy. The food not floating on the surface at the mouth of the stomach is not a final definition, but a formal one. He speaks of health not in a general way but of that which is the result of nutrition. The definition of health in general is the harmony of the four juices.

Being healthy A, i.e. the major term. Maybe someone will raise the difficulty that if being healthy is the final cause of the walking after dinner, than it is set before him (i.e. Aristotle) to show that also the final cause is taken as a middle term in the scientific demonstration, while there he took being healthy as the major term. And we say that that is the further syllogism of the major premise of the syllogism. The syllogism contains 'being healthy' as the middle term. The *suppose* should be understood as instead of "call".

And that, i.e. the food not floating on the surface, belongs to being healthy.

Because it seems, that is: it is agreed upon from all sides, that the definition of health is the food not floating on the surface.

What is then the cause of A, i.e. the purpose, which means that being healthy, which is posited like a final cause in the syllogism, holds of C, i.e. walking. And he says (that) B (is the cause of A), i.e. the food not floating on the surface. And this, I mean the not floating on the surface, is like a definition of that one, i.e. health. And *for A will be explained in this way*, i.e. if someone intends to give the definition of A, that is, of being healthy, that will explain the not floating on the surface.

94b20: “For what reason does B hold of C?”

In the same manner as he showed that being healthy holds of C, i.e. of walking after dinner, through the middle term B, the food not floating on the surface, he tries to show that B, the food not floating on the surface, belongs to C, i.e., walking after dinner, through the middle term A, i.e., being healthy. By using the terms synonymously the demonstration comes to be through each other; walking after dinner and being healthy are, as we say, considered as synonyms. In the same manner someone will show the moon suffering an eclipse, because of the interposition, and also that the moon stands in the way, because of the eclipse. Only when the demonstration comes to be through the first cause, it is true demonstration. When the cause is proved through the effect, there comes to be demonstration, but not in the true sense, because it has the second degree of demonstration and falls away from it.

94b21: “It is necessary to take the phrases separately”²⁷

That is, the syllogisms. Since the syllogisms were set out in a confused way and the syllogism was not set out by itself, nor the further syllogism of the major premise was set out by itself, he (i.e. Aristotle) says: “take them separately, and in that way everything will become clear for you”.

²⁷ This is how Philoponus takes the expression; I think a translation of ‘to substitute for the definitions’ suits the Aristotelian context better.

ARISTOTLE ON CAUSATION AND CONDITIONAL NECESSITY: *ANALYTICA POSTERIORA* II 12 IN CONTEXT

INNA KUPREEVA*

1. INTRODUCTION

One of the debated questions concerning Aristotle's theory of causation is whether it presupposes anything like a necessitation of the effect by its cause. Some texts in the corpus suggest that there is no necessitation in any familiar sense of necessity; others imply that there is 'simple', 'unconditional' necessity operating in natural processes. In this paper I attempt an analysis of a relatively little studied chapter of *Posterior Analytics*, II 12, which may prove useful for our understanding of the problem.¹ This chapter is devoted to the question whether all kinds of causation involve necessitation. Aristotle's main concern is specifically with the case where the cause precedes its effect in time. The term 'conditional necessity' is not used, but Aristotle's discussion sheds some important light on the ways in which this concept is used elsewhere in the corpus, notably in the last chapter of the treatise *On Coming-to-Be and Perishing* (GC II 11) that is devoted to the question whether there is necessity in the world. The paper falls into two parts. The first contains an analysis of Aristotle's argument according to which inferences about a causal process where cause precedes its effect in time should conclude from effect to cause, and not from cause to effect, if they are to be valid. The second part of the paper uses this argument as a background for the

* Earlier versions of this paper were presented to the ESF conference 'Interpretations of *Posterior Analytics*' in Leiden 2004 and the Philosophy Omega Seminar in Edinburgh 2005. I am grateful to the organisers (respectively, Frans de Haas and Jeffrey Ketland), the audiences, and to Natasha Alechina, Pieter Sjoerd Hasper and David Sedley for helpful discussions of the subject matter. It will be clear from the paper that I am hugely indebted to Bob Sharples's groundbreaking work on the subject (even though I disagree with some of his conclusions). He is badly missed.

¹ The recent commentary by Detel (1993) is an outstanding contribution that almost makes up for the lack of critical studies; it provides bibliographical references to each chapter.

analysis of the discussion of conditional necessity in natural processes in GC II 11, and in the work of two ancient commentators, Alexander of Aphrodisias and John Philoponus.

2. ARISTOTLE'S HUMEAN DOUBTS

The difference between the Aristotelian and modern concept of cause is generally well appreciated: Aristotle's causes, unlike modern, are taken to be reasons or 'because', 'explanatory items' rather than causal factors (events or objects) necessitating their effects. However, in several places Aristotle does speak of causes in the meaning close to modern; and in *APo.* II 12, this way of speaking is put in a full-fledged theoretical perspective as Aristotle raises a problem similar to Hume's problem of whether there is a 'necessary connexion' between cause and effect.

2.1. *The Problem*

Aristotle begins by drawing a distinction between the causes of being and the causes of coming to be and perishing:

(T1) What explains why something is *coming about* (and why it has come about, and why it will be) is the same as what explains why *it is the case*: it is the middle term which is explanatory. But if something is the case, the explanatory item is the case; if it is coming about, [the explanatory item] is coming about; if it has come about, it has come about; and if it will be, it will be.
(*APo.* II 12, 95a10–14, trans. Barnes.)

The purpose of this distinction between the causes of being (henceforth, B-causes) and the causes of coming to be (G-causes) is to draw attention to the explanations of particulars, which, as Aristotle rightly suspects, may involve some differences compared to the explanations on the level of essences.

The logical form of a full B-causal statement is that of a syllogism, where the explanatory item (the cause proper) is expressed by the middle term.² In *APo.* I 13, Aristotle gives us an example of causal demonstration:

² Aristotle explains this in detail in *APo.* I 13 and then again (for different types of cause) in II 11. I use the term 'syllogism' loosely, referring to a deduction via a middle term, irrespective of quantification over the terms (what some authors call 'proto-syllogism' or 'deduction' in order to distinguish this form from the syllogism proper discussed in *APr.*).

(T2) Let C be the planets, B being near, A not twinkling. B holds of C and A of B: hence A holds of C. The deduction gives the reason why, since the primary explanation is contained by the premises.

(*APo.* I 13, 78a39–b4, trans. Barnes)

The relation ‘holds of’ between the predicate and the subject can be construed as inclusion of the set corresponding to the subject term in the set corresponding to the predicate term. In our example, $\{C \subseteq B, B \subseteq A\} \vdash C \subseteq A$, more generally, $\{S \subseteq M_B, M \subseteq P_B\} \vdash S \subseteq P_B$.³ This statement explains the resultant state of affairs by showing in its premises the causal constituents of this state. A full G-causal statement does not differ in logical form, but the copula-*cum*-predicate constructions are ‘tensed’. Aristotle mentions three tenses covered by G: the present that can be best rendered by present continuous in modern English ($\gamma\iota\nu\acute{o}\mu\epsilon\nu\omicron\nu$), future ($\xi\sigma\acute{o}\mu\epsilon\nu\omicron\nu$) and past ($\gamma\epsilon\gamma\epsilon\nu\eta\mu\acute{\epsilon}\nu\omicron\nu$). He treats all the G-predicates with the same tense index as simultaneous, and so the interpretation of premises and conclusion is not affected by the introduction of tenses as such.

(T3) (i) E.g., why has an eclipse come about [E]?—Because the earth has come to be in the middle [M]. And [the eclipse] is coming about because [the earth] is coming to be there; [the eclipse] will be because [the earth] will be in the middle; and it is because it is. (ii) What is ice?—Assume that it is solidified water. Water C, solidified A; the explanatory middle term is B, complete absence of heat. Thus B holds of C; and being solidified, A, holds of B. Ice is coming about if B is coming about; it has come about [resp.] if it has come about; and it will be if it will be.⁴

(*APo.* II 12, 95a15–21, trans. Barnes)

We can illustrate this in the following way using symbols:

(i) $P_G(M)$	(the earth's being in the middle comes to be (was, will be) the
	privation of light)
$M_G(E)$	(the eclipse comes to be (was, will be) the earth's coming in
	the middle)
$P_G(E)$	(the eclipse comes to be (was, will be) the privation of light)

³ Barnes chooses to express this relation by means of what he calls a ‘copula variable’, φ, ψ etc. (running over the expressions ‘is’, ‘was’, ‘will be’, and ‘is coming to be’). In addition, he introduces something like a sorted variable over things and events that may be covered by the predicate terms which he calls ‘dummy subject’: $m\psi M$ will translate as ‘the earth is in the middle’; $e\psi E$ (‘there is an eclipse’), etc. I use predicate indices for the same purpose, and traditional notation for the subject terms (although, as will be clear, these will change their reference in accordance with the indexical value of the predicate).

⁴ Cf. Barnes (1981), 38n.32, who cites this as an example of syllogistic imposed on the original non-syllogistic deductions of the Apodeictic. ‘Eclipse’ in this example means ‘eclipsed moon’. I am grateful to Mariska Leunissen for the query.

The use of tenses (especially in the minor premise and conclusion) does not mean that the definition of eclipse is 'relativised', but only that it is valid in each of the three 'generational' tenses as well as in the common present. Similarly, we get an explanation of the event of ice-formation, by taking G-predicates instead of B-predicates.

- | | | |
|------|----------|--|
| (ii) | $B_G(C)$ | (water comes to be (was, will be) deprived of heat) |
| | $A_G(B)$ | (absence of heat is (was, will be) constitutive of solidification) |
| | $A_G(C)$ | (water comes to be (was, will be) solidified) |

The G-deductions are valid as long as the simultaneity of events under the same tense index holds good.⁵

(T4) When an item which is explanatory in this way and the item of which it is explanatory come about, then they both come about at the same time; when they are the case, they are the case at the same time; and similarly for 'have come about' and 'will be'. (*APo.* II 12, 95a22–24 trans. Barnes)

This is probably a methodological device used by Aristotle to prepare the stage for the examination of the main case, namely where premises have predicates with different tense-indices:

(T5) (i) But what of items which do not hold at the same time as one another? (ii) Can it be that, in continuous time, as we think, one such item is explanatory of another? (iii) Can the fact that this item has come about be explained by something else which has come about, the fact that this will be by something else which will be, the fact that this is coming about by something which has come about earlier?

(*APo.* II 12, 95a24–27 trans. Barnes)

We have to note the way Aristotle uses the notion of cause (explanatory item) here. So far we assumed that the middle term is an explanatory item; but now the question apparently is whether the deduction holds if the middle term has different tense-indices in the two premises, and the answer is: no, because the syllogism is just not well-formed. Consider the deduction: $M_P(S), P_F(M) \vdash P_G(S)$ (S has been M, M will be P, hence S is now (or will be) P): how does it fare?

The problem Aristotle raises can be compared with Hume's problem of necessary connexion between the two successive events. But unlike Hume, Aristotle does not intend to subvert the explanation on the level

⁵ Sorabji (1983), 50, mistakenly says that according to Aristotle in this chapter, a syllogism cannot be constructed if all its terms are future-tensed: in fact, Aristotle says, it can, as long as the simultaneity is preserved.

of essences: that is supposed to hold. The question he raises is what happens with the explanatory value of causal account when we move from essences to 'particularised' individual statements. If the explanatory value is upset on the level of individuals, one can see this as potentially damaging to Aristotle's metaphysics of hylomorphism: we are back to the Platonic question whether there can be any knowledge of particulars, in this case of individual events.

Although he initially formulates the problem using the technique of the syllogism, in his analysis of the solution, Aristotle switches to what seems closer to a conditional analogue of syllogistic deduction. His reply to the question is that not all the logical relations between the antecedent (p) and consequent (q) depend on the truth-functional outcome of q 's coming to be when p is true. The converse of the original conditional is also relevant:

(T6) The deduction (ὁ συλλογισμός) is possible if it starts from what has come to be later (but the principle in this case [i.e. in the case of things that have come to be] is something which has already come about), and similarly with what is coming about; but it [the deduction] is impossible if it starts from what is earlier (e.g. 'Since this has come about, this has come about later'). And similarly for what will be the case. For whether the time is indeterminate or determined it will not be the case that since it is true to say that this has come about it is true to say that this—the later item—has come about: in the interval, when the one item has already come about, the statement will be false. (*APo.* II 12, 95a27–34, trans. Barnes, modified)

Paraphrasing the inference from the earlier to the later in terms of propositional logic, we get the formula $p \rightarrow q$, which is not logically true. And even if it is true of a kind of event q that ' q because p ', q cannot be derived from p by a sound inference: for in the case where there is a temporal interval between p and q , $p \rightarrow q$ is liable to be false. The deduction which starts 'from what is later' must have a different logical form. The difference between the two inferences can be described as follows. Let us take the relation ' p is the cause (explanatory item) of q ' or ' q because p ' to be represented by ' p is the necessary condition of q ', which can be paraphrased, using propositional logic, as ' $q \rightarrow p$ '. (This is the weakest representation, sufficient for the purposes of the current analysis.)⁶

In the case of a direct inference from the earlier (p) to the later (q), given that (i) q because p and (ii) p , it does not follow that (iii) q ; or, using symbolism: $q \rightarrow p$, $p \neq q$.

⁶ On this representation, see Mackie (1980), ch.2.

Aristotle agrees with Hume that the relation of ‘causation’ (however understood) between p and q does not convert into a valid inference from p to q . Unlike Hume, however, he apparently believes that the reverse inference, from q to p , as warranted by a causal connexion, can validate a deduction of p as the (antecedent) cause of q . Thus, in the case of ‘oblique’ inference, given that (i’) q because p and (ii’) q , it follows that (iii’) p , if ‘ p then q ’ is necessary (formalising, $q, q \rightarrow p \vdash p$, just a *modus ponens*).

So, Aristotle allows for the ‘transition of kind’ based on a constant conjunction of cause and effect prohibited by Hume, but with this restriction: it can go only in one direction, i.e. from effect to (antecedent) cause, but not the other way around.

2.2. Aristotle on the Ontology of Causal Processes in Time

Setting out the ‘Humean’ problem, Aristotle asked: ‘Can it be that, in continuous time, as we think, one such item is explanatory of another?’ Having outlined the conditions of valid inference from effect to cause, he returns to this question and explores the possibility of validating the causal connexion between earlier and later events by taking them to be continuous because of the continuity of time. This possibility ultimately does not work, but the discussion is used by Aristotle, first, to back up the difference between the two kinds of inference, namely the direct inference from the earlier to the later and the oblique one from the later to the earlier, and second, to explain why the latter is and the former is not acceptable on the basis of the ontology of causal processes regarded as events in time.

(T7) (i) We must enquire what it is that holds things together (τί τὸ συνέχον) so that after what *has come* about there are items which *are coming* about. (ii) Or is it plain that what is coming about is *not* contiguous (ἐχόμενον) with what has come about? (iia) What came about is not contiguous with what came about, since these things are limits and atomic: just as points are not contiguous with each other, so items which came about are not—both are indivisible. (iib) For the same reason, what is coming about is not contiguous with what has come about. What is coming about is divisible, whereas what has come about is indivisible: what is coming about stands to what has come about as a line stands to a point, and infinitely many items which have come about inhere in what is coming about. (But I must discuss this more clearly in my general account of change.) (APo. II 12, 95b4–12, trans. Barnes)

The question under investigation is whether it is possible to speak of two distinct events corresponding to cause and effect as continuous in such a

way that if the cause is already present, the effect will necessarily follow because both have temporal structure and thus share in the continuity of time. On this view, the effects would 'flow' from their causes, so to speak, so that positing the occurrence of a cause will necessarily involve an effect in due course.

Aristotle uses two concepts of continuity when speaking about temporal processes. In the statement of the problem he seems to be thinking of the continuity of time in the sense of 'division': for any two moments t_1 and t_2 , where $t_1 < t_2$, there will always be a point t_3 such that: $t_1 < t_3 < t_2$.⁷ The continuity thus understood is a property of the time-line as a whole or any of its intervals that are not individuated by an actual division.

The continuity referred to in our passage is the continuity 'by limits'.⁸ It is a relation between two individuated events or processes in time. This concept of continuity is of interest in the analysis of a causal link between two events in a temporal sequence. Aristotle here invokes his definition of continuity developed specifically for the analysis of change in *Ph.* V 3. According to the series of definitions set out there, A is *contiguous* (ἐχόμενον) with B, if it is *successive to* (ἐφεξῆς) B and *in contact* (ἀπτόμενον) with it (*Ph.* V 3, 227a6). A is continuous (συνεχές) with B if it is contiguous with B and the limits of A and B have become identical and are held together (227a10–12). Aristotle explains that A and B are in succession if they do not have anything *of the same kind* between themselves (one could think, for instance, of numerical successions). A and B are in contact if they have their limits together, i.e., so that nothing (at all) is between them. The continuity involves an additional condition of unity of these limits.

In his solution (see T7 (ii) above), Aristotle explores the possibility of the cause and effect being made *contiguous* by the time's continuity 'of division'. His point of departure is the view of time as a continuum that is potentially divisible at any point. The parts of a time-line could be treated as continuous if they are regarded as the parts of a potential division, i.e., when they are not individuated by an actual process of division which marks the boundaries of events in actuality. The parts of potential division are presumed to be in contact; moreover, they are 'one' because the point in time in this case can be treated as both two and one,

⁷ Cf. *Ph.* V 3, 227a10.21; V 4, 228a29; VI 1, 231a22; VI 6, 259a16, 19; *Met.* XI 12, 1269a5, 10.

⁸ Cf. *Ph.* I 2, 185b10; III 1, 200b18–20; VI 1, 231a22–b6; VI 2, 232a24; 233a25; 233b17–31.

just as a geometrical point.⁹ The actual division of time involves a certain interruption, so that the point of division will be the actual turning point between two processes of change. This kind of interruption imposes a peculiar structure on the individuated temporal parts: a change over an interval of time has no starting point but does have a point at which it is completed.¹⁰ As a result, any actual part of time (and a single process) is represented as an interval which is open and divisible on the left-hand side and closed on the right-hand side.¹¹

In T7 (iia) and (iib), Aristotle exploits the thesis that no continuum can come about from the indivisibles: the indivisibles do not have their limits as one, nor do they have their limits together, i.e., they are not even contiguous.¹² The important point of this analogy (in which points, moments, and events are jointly contrasted with sensible things) is that successions formed in the former class cannot amount to a continuum of any kind. In the case of geometrical limits and potential points of division in time, the reason is that there is always a ‘stronger’ continuum intervening between any two indivisible points of a line or duration (*Ph.* VI 1, 231b6–10)

Thus a causal sequence does not involve the contact of limits, but, as Aristotle tells us next, it has instead the order of succession, whose members are consecutive (ἐφεξῆς). Consecutive events (while being indivisible) do not have anything of the same nature coming between them (there is no corresponding stronger continuum of change or coming to be). If I understand him correctly, Detel takes Aristotle’s argument to be the following: the continuity does not hold of coming to be because it does not

⁹ *Ph.* IV 11, 220a12–13, *Ph.* VIII 8, 262a12–263b9; Coope (2005), 11–13.

¹⁰ “The first [moment] in which a thing has changed is said in two ways, namely, the first moment in which change has been completed (for at that point it is true to say that a thing has changed), or the first moment at which it has started changing. That which is called first in the sense of the end of change is real and exists (for a change can be accomplished, and there is the end of change, which has been proved to be indivisible on account of its being a limit); but [‘the first’] in the sense of the starting point does not exist at all: for the starting point of change does not exist, nor does the first moment of time in which it [started] changing.” (*Ph.* VI 5, 236a7–15).

¹¹ In *Ph.* VI 9, Aristotle uses the term κίνημα, in contrast with κίνησις, to refer to a single unit of change. *Ph.* VI 9, 241a2–4: οὔτε γὰρ ὁ χρόνος ἐκ τῶν νῦν οὐθ’ ἢ γραμμῇ ἐκ στιγμῶν οὐθ’ ἢ κίνησις ἐκ τῶν κινήματων. Cf. *Ph.* VI 1, 232a7–9. This contrast is used by both [Philoponus] at 391.1–5 and by Eustratius at 161.32–162.20 (γένεσις and γένημα, 161.39).

¹² Cf. *Ph.* VI 1, cf. VI 6, 237b7–8 and VI 5, 236b11–12.

even hold of time in the sense that is required.¹³ But I think this might need a qualification since time generally speaking allows for the analysis in terms of potential division so that between any two points a further point is conceivable. It is the actual division of time, shaped by the events in time, that does not satisfy the conditions of continuity that are required in order to validate the direct causal sequence from the earlier to the later events.¹⁴

The exact force of Aristotle's argument has been questioned by his commentators. Most ancient commentators take Aristotle's argument to be against the continuity of events in time rather than against contiguity,¹⁵ which they did not regard as problematic. But contiguity is a weaker relation, and strictly speaking it might leave open the possibility for the contiguity of cause and effect. Barnes has made an impressive case for such a weaker relation where two events, the one a completed event A and the other an open-ended event B, can be said to be 'contiguous' in the sense that it should be possible to assume that, although the last moment of the event A (t_a) does not 'contain' any of the event B, any further moment in time t_c (however close to t_a), does contain the event B, so that there will be no 'time' intervening between the two events.¹⁶ But it is not obvious that this weak analysis of contiguity is accepted by Aristotle. He could say that even on this analysis there is always a time *interval* between the end of A and any arbitrary point of B, however close to A. After all,

¹³ Cf. Detel (1993), 730 (ad 95b1, a paraphrase of the *Physics* arguments about continuum).

¹⁴ It may be relevant, too, that some ancient commentators (such as Themistius) note the role played by *phantasia* in deriving the concept of the continuity of events from the continuity of time (this has to do with the fact that time does have a different order of continuity compared to change and coming to be).

¹⁵ So Themistius (54.8–15 W.), [Philoponus] (390.5–391.5), Anon. (575.27–576.15 W.), and Averroes. Averroes summarises Aristotle's argument as follows: "He means two things, assuming that the one that is in the prior moment is prior, and the one that is in the posterior moment is posterior; and it is as though he said, the reason why the posterior is not continuous with the prior is that the very last moment of the coming to be of the prior thing, i.e., when it is true to say of the first that it has come to be already, is not continuous with the moment at which it is true to say of the posterior thing that it has come to be."

But since someone might say that since both the prior and the posterior things are bodies, and bodies are divisible, and things that are divisible can be continuous with each other, as a reply, he said: and that which will be is divisible, but the thing which has already come to be is indivisible, i.e., that which is coming to be is divisible, but the moment in which it is true to say that it has already come to be is indivisible." (Averroes, *Comm. magnum*, 494B12–D7 (Abram.))

¹⁶ Cf. also Ross ad loc.

the concept of contact between the limits may be important in indicating the kind of continuity that is relevant in the analysis of real events and causal sequence, and that may be the reason why the case is explicitly made against the contiguity of events in time, even though the key concept in the argument seems to be that of continuity.

On the basis of this ontology, Aristotle formulates his explanation of the kind of deductive reasoning that preserves its validity in the cases where cause and effect are separate in time. He says:

(T8) Here too (i.e., in the case of events that come about in succession) the middle term and the first term must be immediate. E.g., A has come about since C has come about (C has come about later, A earlier; but C is the starting point since it is nearer to the present moment, which is the starting point of time); and C has come about if D has come about. Thus, if D has come about, A must have come about; and C is the explanation—for if D has come about, C must have come about, and if C has come about, A must have come about earlier.

(*APo.* II 12, 95b14–21, trans. Barnes, modified)

The expression ‘things that come about in succession’ is noteworthy here, because it refers to an ordered succession where there is nothing of the same kind in-between. C is immediate with respect to D, and A is immediate with respect to C, because in the logical structure of the explanatory account, there can be no further explanatory step between C or D, nor between A and C. Aristotle illustrates this with an example of a sequence of operations in house building:¹⁷

(T9) In concrete terms it is like this. If a house has come about, stones must have been cut and have come about. Why? Because a foundation must have come about if a house has come about; and if a foundation has come about, stones must have come about earlier. Again, if there will be a house, in the same way there will be stones earlier. As before, the proof is through the middle term: there will be a foundation earlier.¹⁸

(*APo.* II 12, 95b31–37, trans. Barnes)

The validity of the oblique inference from effect to cause is grounded by this type of causal sequence. The causal sequence is given beforehand, as a part of a rich explanatory account of the effect. The direct inference from cause to effect cannot be validated in the same way (despite the fact that

¹⁷ Cf. also parallel biological examples, most clearly in *PA* II 1, 646a25–b4; also *PA* I 1, 640a16–19; *GA* I 22, 730a5–8; II 1, 734b13–17; *EN* VII 11, 1152b12–15, cf. *EE* 1219a13–17; *Ph.* III 1, 201a15–19; b9–13; *Met.* XI 9, 1065b16–66a7.

¹⁸ On the use of syllogistic terminology, see Barnes (1981), 38n.32.

the rich explanatory account is the same), because the intervening factors from outside the causal series can disrupt it and block the outcome. Only the completed outcome shows that there has been no interruption of the causal sequence that has preserved the order of 'succession' as defined in *Ph.* V 3. Aristotle's example of house-building should not be taken to mean that the analysis is restricted to the cases of final causality: it applies also in the cases of efficient and material causation. In this respect it may be appropriate to look at two difficulties with this analysis stated by the commentators of Aristotle, both recent and ancient.

The first difficulty is raised by Barnes, who points out in his commentary that we cannot infer 'Socrates drank hemlock' from 'Socrates died', suggesting that Aristotle thinks we can.¹⁹ But in Aristotle's analysis the assumption (the causal statement, 'q because of p') is not derived from a given outcome (q), but is presupposed as an assumption in this further analysis in terms of implication. As Wieland has pointed out, Aristotle's methodological procedure here is not a search for causes using logic as a tool, but rather provides a means for justification, in terms of his theory of deduction, of the already discovered causal relations, thereby providing the independently established explanation with a suitable logical framework.²⁰ That the object of *Posterior Analytics* is not the 'logic of discovery', but rather the logic of explanation is a common point which has been argued in a more general way by a number of scholars including Barnes himself; it applies in this particular analysis as well.

The second difficulty is potentially more serious. It has to do with the question: Does Aristotle mean to deny direct necessity in causal processes? This problem has been raised by both ancient and modern commentators. Barnes has argued that it should be possible for us to say that someone who has drunk a lethal dose of hemlock will necessarily die. The same point is made in Philoponus' commentary on *GC*,²¹ when he says that there are things that are not necessary by themselves but are necessarily caused by some contingent factors.

Detel has replied to Barnes's query by distinguishing between the two meanings of 'lethal': the first is 'bringing about death', in which case, he says, the term is analytic and should not be treated within the scope of causal analysis. The second is 'conducive to death', in which case there remains a room for intervening factors that may block the

¹⁹ Barnes (1993), 235.

²⁰ See Wieland (1972).

²¹ Philoponus in *GC* 308.13–28. Cf. p. 227 below.

causal path.²² In fact this example could be accommodated by Aristotle's analysis of causal inference in this chapter, *APo.* II 12. Assume that the conclusion is: 'Hemlock causes death', the major premise: 'What destroys the vital organic systems causes death', the minor: 'Hemlock destroys the vital organic systems'. We can get a sound syllogism in the first figure. The next question is whether in virtue of this we can derive 'X will die' from 'X drank hemlock'. This obviously will depend on whether in this particular case hemlock destroyed X's vital organic systems, something that is not to be taken for granted, because hemlock's action could be impeded by some counteracting factors, which would disrupt the causal series and prevent the result from happening. In a 'normalised' version of our syllogism we would work on the assumption of the subject being a normal organism and of the action of hemlock being normal, without in addition assuming any interfering circumstances that might cancel its effect, such as taking an antidote etc. In the case of an individual future event we are not entitled to this assumption, so from 'X drank hemlock' we can only conclude 'X will die' if hemlock's action will not be prevented by some counteraction that does not belong to this causal series. (Think of Rasputin's murder as an example of the case where reportedly the lethal dose of potassium cyanide (KCN) did not work at all.) Thus the version of the syllogism which can claim certainty is either 'analytical' (in Detel's suggestion), or such that the middle term has the same tense-index as the predicative term, i.e., (following Aristotle's analysis) when cause and effect are treated as 'simultaneous', without a time lapse between the *explanandum* and *explanans*.

2.3. *Two Kinds of Necessity: A Distinction Indicated*

In *APo.* II 12, Aristotle does not use the concept of conditional necessity, but his discussion does have bearing on this concept as used by him elsewhere. In particular, Aristotle's discussion here indicates an important distinction that needs to be drawn between the two senses of conditional (hypothetical) necessity in the corpus. In a more familiar sense, conditional necessity refers to the kind of necessity induced in a material process by a final cause. In this sense, conditional necessity is opposed to 'simple' or 'unqualified' necessity that does not presuppose a final cause and which represents another way of referring to material causation.²³

²² Detel (1993), II, 738.

²³ The main texts are *PA* I 1 and *Ph.* II 9.

Conditional necessity in this case refers to the necessary conditions of the coming to be of a given natural kind. In biological texts in particular, the term 'conditional necessity' expresses the fact that a certain type of structure is 'essentially' necessary for a certain function: this is how the end 'necessitates' the means. The 'necessity' which is so imparted has to do not with the factual outcome of each individual process of coming to be: an embryo may perish prematurely, and a house may be left unfinished because of some external interference, but the coming to be or presence of the incipient proximate matter of each incomplete compound is necessitated by the final cause to no less an extent. Hypothetical necessity is construed as working backwards, *a fronte*, and contrasted with 'simple' necessity which works directly, *a tergo*. The problem that has been much discussed is whether Aristotle recognises this latter kind of necessity as operating in natural processes: there are important texts which suggest that in the realm of nature, the 'necessary cause', or matter, is always subordinate to the final cause,²⁴ and moreover, that 'absolute' necessity only belongs to the eternal (viz. heavenly) objects.²⁵ The main contrast drawn by scholars is between matter and purpose, and those who argue for the existence of simple necessity in natural processes argue for the independent causal force of matter (in this debate, 'unconditional' is understood as not being subjected to teleological conditioning).

The second context in which 'conditional necessity' occurs has to do with the question whether the cause which precedes its effect in time necessitates the outcome. The 'condition' on which this kind of conditional necessity is based is that the effect be realised. An important text is *GC* II 11, where Aristotle argues that things that come to be are divided into those that do so necessarily (i.e., come to be always) and those that are contingent (i.e., sometimes come to be and at other times do not). Simple necessity means in this case that an outcome of a given process of coming to be does not depend on any conditions at all (i.e., cannot be stopped by the interference of any external factors). In this context, Aristotle suggests that *all* sublunary necessity is conditional, while simple necessity is found only in circular processes, such as the circular motion of heavenly bodies. Sometimes the two contexts, teleological and modal, appear to overlap, as in *GC* II 11, where Aristotle illustrates the modal distinction with the example of house-building—an example that is typically invoked in the biological corpus to illustrate conditional necessity in

²⁴ *Ph.* II 9; cf. Cooper (1987), Johnson (2005), Sedley (2006).

²⁵ *PA* I 1. cf. Johnson (2005), 162ff.

the causal sense, as the necessity imparted by the final cause. As a result, the concept of 'absolute', unconditional necessity, or necessity *a tergo*, is sometimes taken to refer to all necessity of non-final origin, and Aristotle's argument against the necessity *a tergo* is taken to deny the causal force to any non-teleological factors in nature.²⁶

It seems useful to distinguish these two senses of conditional necessity: first a non-modal sense, which refers to conditional necessity as operating in each process of change through several causal factors (so that for each process of change we have a final cause which defines the conditions of material causation, but also the efficient cause which will to some extent rely on matter in contributing to the outcome), and second, a modal sense, i.e., one that is based on the distinction between the necessary and the contingent. *APo.* II 12 supports this distinction, because Aristotle's analysis here follows upon an argument covering all the four types of cause (in *APo.* II 11), and is to be taken as applying to all the four cases. Thus 'necessity' is used in a different sense, i.e., as characterising the relation between the cause and effect *within* any type of causal sequence. The necessity of an individual outcome is made dependent on the validity of an inference from the earlier cause to its effect that comes about later. This discussion shows the grounds of Aristotle's treatment of simple and conditional necessity in *GC* II 11.

3. CONDITIONAL NECESSITY AND NATURAL CYCLES (*GC* II 11)

In *APo.* II 12 Aristotle outlines some problems which he considers in detail in *GC* II 11. The main problem discussed in *GC* II 11 is whether there is simple necessity in the coming-to-be and perishing within the cosmos. The chapter has been regarded as controversial because it seems to claim that simple necessity is found only in the heavenly revolutions, while other texts (such as *Phys.* II 9 and the biological treatises) suggest it exists also in sublunary natural processes. We have seen that the concept of simple necessity is used by Aristotle in two different senses and in two kinds of context. In this section, I consider the bearing of this difference on our understanding of the discussion in *GC* II 11, while paying special attention to the interpretations offered by ancient commentators.

²⁶ This interpretation surfaces in some ancient commentaries (e.g., in Philoponus, on which below), and is suggested in some modern studies (Sharples 1979).

3.1. *Some Further Problems Outlined: The End of APo. II 12*

Having discussed the structure of a causal sequence that validates the conclusion from effect to cause through a middle term, Aristotle turns to the case of circular sequences. In the final section of *APo. II 12*, he speaks of natural cycles:

(T10) (i) We observe among events a sort of circular coming about. This can be the case if the middle term and the extremes follow one another: they must convert (as I proved in the beginning) because the conclusions convert; and this is what being circular is. (ii) In concrete terms it looks like this. If the earth has been soaked (A), necessarily steam came about (B); if steam, cloud (C); if cloud, water (D); and if water came about, it is necessary for the earth to have been soaked. But this was the starting-point, so that things have come round in a circle: if any item is the case, another is; if that, another; and if that, the first.

(*APo. II 12*, 95b38–96a7 trans. Barnes)

The overall purpose of this turn in the discussion is not immediately obvious. In the immediate context of the argument its force is a contrast with the just discussed linear causal sequences with a definite starting and end-point. Such definite limits in a strict sense are not found in the cycles. This example raises a whole number of problems. Does Aristotle perhaps mean to relax the restriction on the inference from the earlier to the later in the case of cyclical processes? As Detel points out, Aristotle cannot be taken to suggest that there is a circular ‘demonstration’ of any sort available in the case of such cycles.²⁷ Aristotle already dealt with circular demonstrations in *APo. I 3* and concluded there that they are generally impossible. However, he does mention one exception, namely a very special and rare case in which the three terms of the syllogism are convertible (follow upon, or are ‘counter-predicated’ of each other).²⁸ This case can stand as far as the validity of the deductive procedure is concerned; but the plausible real instances of such a relation are supposed to be virtually non extant.

In our passage (T10), Aristotle describes the terms of circular deduction in question as convertible, thus perhaps referring to the same rare exception as the one he allowed for in *I 3*. We should note, however, that

²⁷ Detel (1993), ad loc. Cf. Barnes (1975) and (1976), suggesting that Aristotle reverts to his own earlier view that circular demonstrations are possible (assuming that one of the three ‘circular demonstrators’ in *I 3* is young Aristotle). Barnes (1976), 239, suggests that ‘Aristotle toyed with the idea of representing the natural cycles of *GC II 11* by means of circular demonstrations’.

²⁸ *APo. I 3*, 73a6–20; see Smith (1986).

this kind of mutual predication differs somewhat from the one licensed in I 3 in that here Aristotle is talking about the G-terms and not the B-terms as in the earlier discussion; i.e., his subject is particulars rather than essential *explanantia* and *explananda*, and this makes a difference. This difference is underscored by the fact that in the current example the particular *explanans* and *explanandum* are always separated by a time interval: air cannot be simultaneous with the water it comes from. The example of elemental transformations is thus special in that, for the elements, we do not have a B-version of deduction, i.e., qua B-terms, the elements are not convertible in a strict sense: air is not water, but becomes water as a result of transformation. This raises some problems about the ontological status of the elements that are represented by convertible G-terms.

The example of elements is adduced to illustrate the kind of deduction that might be different in form from the one discussed in 95b16–35: in these transformations it does not matter what term is chosen as the starting point of reasoning. It is worth pointing out that the force of this illustration is not made explicit by Aristotle, and perhaps we should be careful not to seek to disambiguate it too soon. In particular, we are not warranted in thinking that this case must constitute a breach of the analysis of causal deduction stated earlier. A weak reading of the example is possible if we parse the cycle into regular three-term deductions. Then every such deduction would still contain three (convertible) terms, and proceed from the starting point of reasoning (i.e., the realised effect of a given transformation) to its end-point (the starting point of this partial transformation) via the middle term. A strong reading, according to which this example would constitute a case of circular demonstration, is not suggested by the text,²⁹ although the problem is clearly flagged, and the possibility is not ruled out. It seems that in this chapter the example is cited to highlight the problem, and that Aristotle deals with it elsewhere, namely in GC II 11. His remarks that follow upon this discussion in *APo.* II 12 sound rather general; his wording may well be deliberately chosen so as to leave room for a not-too-strong reading of the illustration. Aristotle says:

(T11) Some things come about universally (they either are or come about in this way always and in every case), others not always but for the most

²⁹ As Detel (1993) points out, Aristotle here avoids the use of the terminology of ‘demonstration’.

part—e.g. not every male man has hair on his chin, but they do for the most part. In such cases the middle term must also hold for the most part.

(*APo.* II 12, 96a7–12 trans. Barnes)

Notably, there is no example of things that come about in this way always (but it will come up in *GC* II 11). The claim that the middle term holds for the most part seems to involve some sort of a weighted quantification procedure over the individual causal sequences considered in this chapter, i.e. those with uncertain outcome. It is unclear whether Aristotle has in mind any particular mechanism of quantification.³⁰ What seems important, particularly in the light of this example, is that the operation of ‘simple necessity’ understood in the sense of material causality has its way ‘for the most part’, i.e. not in virtue of ‘simple necessity’ understood as an absolute necessity of an outcome. This example again indicates the distinction between the two senses of necessity. With this in hand, we can look at the argument of the *GC* II 11.

3.2. *Necessity in GC II 11: Aristotle and His Ancient Commentators*

The main problem discussed by Aristotle in *GC* II 11 is whether anything comes to be of necessity or whether everything that comes to be is contingent. Already its first formulation shows that it arises from Aristotle’s interest in the natural cycles. The logical structure of these cycles is of the kind described at the end of *APo.* II 12. The main argument of the *GC* chapter also displays a number of parallels with the argument of the *Analytics*: the question Aristotle asks and goes on to discuss is whether we are justified in deriving the necessity of the effect (or a later outcome) from the existence of the cause if the cause (or an earlier event) is regarded as a necessary condition of this effect (later event):

(T12) (1) Granted that the coming to be of something earlier is necessary if a later thing is to be, e.g. if a house, then foundations, and if foundations, then clay, does it follow that if there have come to be foundations a house must necessarily come to be?

(2) Or can we not yet say this, unless it is necessary simpliciter that the latter itself come to be? In this case, if foundations have come to be, it is also necessary that a house come to be; for such was the relationship of the earlier thing to the later, namely, that if there is to be the latter, necessarily there will be the former, earlier thing.

³⁰ For discussion of the meaning of ‘for the most part’, see Mignucci (1981).

(3) If, accordingly, it is necessary for the later one to come to be, it is necessary also for the earlier one, and if the earlier one comes to be, it is accordingly necessary for the later one to do so—but not because of the earlier one, but because it was assumed that it was necessary it should exist. So in those cases where it is necessary for the later one to exist, there is conversion, and it is always necessary, if the earlier has come to be, that the later should also come to be. (GC II 11, 337b9–25, trans. Williams)

The example used in (1) is the same as in *APo*. II 12 95b32–37; notably, it is not an example of a cycle, but of a linear causal sequence which grounded the oblique inference from effect to cause. Aristotle approaches the modal problem of necessity by re-stating the question resolved in the *Analytics*: given that (i) $q \rightarrow p$ and (ii) p , does it follow that (iii) q comes to be of necessity? The necessity mentioned here does not need to be rendered as a modality of p : the question is about the logical form of inference; its solution does not depend of whether we prefix the operator of necessity to (i) and (iii).

In (2) Aristotle sketches a solution which is then stated in a somewhat different form in (3). The solution involves postulating the necessity of the later outcome of an earlier event. Formalised proof would look like this:

- (i) $\Box q$
- (ii) $q \rightarrow p$,

Hence,

- (Δ) $p \rightarrow q$ (supplying steps (iii) $\Box q \rightarrow q$; (iv) q ((i),(iii)); (v) p ((ii), (iv))).

The necessity of inference in the conclusion is not modal, but deductive: it is shown that it is properly derived from the assumptions. In other words, the deduction (i) q ; (ii) $q \rightarrow p$; (Δ) $p \rightarrow q$ would also be valid; and a more general case (i) q^* ; (ii) $q^* \rightarrow p^*$; (Δ) $p^* \rightarrow q^*$, where the asterisked letters stand for metavariables running over modal and non-modal atomic sentences.

In (3) the assumptions seem to be, from generalised version:

- (i) $\Box q$
- (ii) $\Box q \rightarrow \Box p$;

Hence,

- (Δ) $\Box p \rightarrow \Box q$.

The conclusion says that in the processes in which the later is necessary, the earlier is also necessary, not by itself but by conditional necessity

operating *a fronte*, as a condition of an outcome which is necessary by itself. From arguments (2) and (3) it is clear that conditional necessity represented in two conclusions has a deductive nature, even though in (3) both the antecedent and the consequent have modal operators.

But there is also a question about the nature of the simple necessity of the outcome, postulated as the first premise ($\Box q$) in both arguments (2) and (3). Aristotle in fact goes on to show that such necessity can accrue only to the things whose coming to be has a cyclical pattern, and of these only heavenly bodies possess the simple necessity of coming to be because only this type of cycles involves continual repetition of the same pattern with the same individuals. The concept of simple necessity referred to here clearly differs from the concept used to describe material necessity operating in natural processes. Here Aristotle speaks of the kind of natural necessity that could validate the deduction of an outcome from its antecedent, as in $\Box p \rightarrow p$, only stronger, validating an conditional of the form: $\Box p \rightarrow q$. Most processes do not have this kind of necessity; only the phenomena of heavenly rotation have guaranteed outcomes for any earlier state of affairs.

Aristotle's argument for circularity is constructed as a refutation of other options, namely finite generation and infinite generation in a straight line.

The former option is ruled out because it lacks one essential attribute of necessity—the provision of eternity. Aristotle illustrates this case with house-building example which previously served to illustrate the necessity of the oblique inference from effect to cause when the effect has been realised (GC II 11, 337b29–33). Here Aristotle emphasises that the effect does not possess simple necessity. The reason he gives is that this kind of effect does not possess eternity: eternity is a required attribute of necessity.³¹ The notion of eternity he uses deserves some attention. This is not just a provision that the number of future instances of house-building is infinite, or that house-building as an activity will never cease—as it probably will not, on Aristotle's view of the permanence of the human species. It includes a stronger requirement of continuous recurrence in the same order, so that the eternity should be realised in a continuous series of individual processes of coming-to-be which follow upon each other. Such are processes in nature, where there can be no gap between

³¹ τὸ γὰρ ἔξ ἀνάγκης καὶ ἀεὶ ἄμα (337b35). As Philoponus' commentary says, ἄμα is to be understood as 'the same' (310.32). This is the emphasis of the discussion of simple necessity, rather than its lacking any conditions at all (so Sharples (1979), 32).

the two comings-to-be, in the sense that each one presupposes another one upon which it follows and provides a condition for its possible successors in the series.³²

The next part of the argument deals with the second option, proving that simple necessity cannot be realised in an infinite rectilinear series, i.e. open series, where each member is followed by a different one without significant repetitions. Such series, being unlimited, would seem to be able to accommodate the eternity or permanence required by simple necessity. But this is not the only condition of necessity in a required sense. Aristotle is looking for a kind of structure that would satisfy the conversion, whereby $q^* \rightarrow p^*$ would entail $p^* \rightarrow q^*$. This would be allowed by the case where q is necessary *per se*, i.e. q (or $\Box q$, depending on the version) could be added to the set of assumptions, giving $\{q^* \rightarrow p^*, q^*\}$, to derive $p^* \rightarrow q^*$. Such a structure is not available in an infinite rectilinear (i.e. non-recurrent) series. The reason is that in the open series q will itself depend of some member different from the previous sequence, e.g. r^* , such that $r^* \rightarrow q^*$, that on some further, e.g. s^* , $s^* \rightarrow r^*$, etc. So to get the required derivation we would have to include in our set of premises all those further antecedents: this would make it infinite. As Aristotle says,

(T13) If, then, it proceeds to infinity downwards, it will not be necessary *simpliciter* for this (one of the later ones) to come to be, but only conditionally; for there will always have to be some further thing in front of it on account of which it is necessary for it to come to be; so, given that the infinite has no principle, there will be no first member on account of which it will be necessary for it to come to be.³³

(GC II 11, 337b25–28, trans. Williams)

It has to be pointed out that this kind of infinite structure does not preclude the existence of conditional necessity operating *a fronte*. It is perfectly legitimate to take a completed section of this series which begins with a cause and ends in its effect, and conclude from the effect to the (earlier) cause. But this will not give us simple necessity in the sense required by Aristotle, because this derivation will account only for this individual case, but not for the permanence of this outcome in a continuous series.

³² This is how the scope of investigation has been described at the start of the chapter: τὸ ἐφεξῆς ὃν καὶ γινόμενον τόδε μετὰ τόδε ὥστε μὴ διαλείπειν (337a34–b1).

³³ Εἰ μὲν οὖν εἰς ἄπειρον εἴσιν ἐπὶ τὸ κάτω, οὐκ ἔσται ἀνάγκη τῶν ὑστέρων τόδε γενέσθαι ἀπλῶς, ἀλλ' ἐξ ὑποθέσεως· αἰ γὰρ ἔτερον ἐμπροσθεν ἀνάγκη ἔσται, δι' ὃ ἐκεῖνο ἀνάγκη γενέσθαι. "Ὡστ' εἰ μὴ ἔστιν ἀρχὴ τοῦ ἀπείρου, οὐδὲ πρῶτον ἔσται οὐδὲν δι' ὃ ἀναγκαῖον ἔσται γενέσθαι. * ἀλλ' EWF¹J¹ Alexander (presumably on the basis of *Quaest.* II 22, III 5) ἀλλ' οὐδ' LHV Philop^c ἀλλ' οὐκ M. Cf. p. 225n39 below.

This part of Aristotle's proof was found difficult by commentators, ancient and modern. Alexander of Aphrodisias apparently gave two explanations of the arguments which were known to his school. *Quaest.* II 22 has a title 'Explanation of a passage from the second book of Aristotle's *On Coming-to-Be and Passing Away*, differing from that in the commentary on it'.³⁴ In this treatise, Alexander reconstructs Aristotle's argument as follows:

(T14) If [i] it were shown that it is only (in) those cases where what is later is of necessity that 'if what is first, of necessity what is later' is true, and [ii] in the case of coming-to-be to infinity that which is later is not of necessity, because it does not even come to be the same; [then] [iii] neither would anything before that which came to be last come to be of necessity without qualification, [iv] because the things that precede the final [member of the series] only derive necessity without qualification from the end if this comes to be of necessity without qualification. (71.9–15, trans. Sharples)

In [i] Alexander seems to give a modal version of the main result of *APo.* II 12, which was that an inference from the earlier cause to the later outcome is valid only when the outcome has occurred. There we had $p \rightarrow q$ true if (i) q because p ; (ii) q , via (iii) $q \rightarrow p$. Here we have $\Box(p \rightarrow q)$ if (i) q presupposes p ; (ii) $\Box q$; via something like (iii) $\Box q \rightarrow \Box p$. Here it is the validity of a modal inference that is in question, hence the requirement that the later outcome be necessary, not just true.³⁵

In [ii], Alexander apparently is trying to capture the lack of regularity in an infinite linear series. It is not entirely clear from our text what he means by 'never coming to be the same'. The possibilities include: (a) a series with no type or token repetitions at all: this will make the point, but is too strong; (b) a series with type but not token repetitions,³⁶ with two versions: (b') type-regular sequence constituted by different tokens; (b'') a series of random type-repetitions instantiated by different tokens. Now, (b') can hardly be Alexander's choice: in *Quaest.* III 5, as we shall see shortly, he considers this to be a weakened variant of cyclical pattern; this would not be a clear example of rectilinear infinite series. (a) would be a clear refutation, perhaps too strong, but conceivable, particularly given that Aristotle himself uses something like this in his proofs of circular character of elemental transformations in *GC* II 5, where he uses different letter characters for different elements to illustrate the (refuted) hypothesis of linear infinite change (see Appendix 2 and 3). But in fact (b'') would

³⁴ 71.3–5 Bruns; trans. Sharples.

³⁵ On Alexander's commentary on *APo.* in general, see (Moraux) 1979.

³⁶ Along the lines of Sharples's suggestion, Sharples (1994), n. 123.

suffice to make the required point, namely, that in this sequence later outcomes do not possess necessity. The reason is precisely the random character of the series in question which does not allow us to assume a regular completion of each 'minimal' causal sequence $\langle p; q \rangle$. In *APo.* II 12, the inference from the earlier cause to its later effect is not logically true because there can be an instance when the antecedent representing cause is true and the consequent representing the effect false. In this case, the inference will not be necessary even if its one non-modal instance is true because the necessity requires that it be true always.³⁷

The conclusion [iii] is that there is no simple necessity in this kind of infinite series. A couple of lines down, Alexander explains that later outcomes (the right hand-side members of successive causal pairs $\langle p, q \rangle$) in such series can possess conditional necessity insofar as they themselves are necessary conditions of the outcomes already completed. Here Alexander uses the notion of simple and conditional necessity in the logical sense, borne out by the analysis of 'causal' deduction in the *Analytics* chapter. The thesis he attributes to Aristotle is that direct necessity from cause to effect does not obtain except in the circular processes for logical reasons. That this is his interpretation of the main claim of *GC* II 11 is clear also from his analysis in *Quaest.* III 5, which does not differ in its main points from *Quaest.* II 22.

The thesis attributed to Aristotle at several points in Philoponus' commentary seems to be rather different. The composition of Philoponus' *GC* commentary is complex and the authorship of different arguments possibly varies. *In GC* is considered to be one of the earliest writings by Philoponus; technically, it is a set of notes taken in Ammonius' seminars. Ammonius, himself an original thinker, makes ample use of the lost commentary by Alexander, which Philoponus also might have consulted when writing his notes. Philoponus sometimes registers disagreement with his master's argument and adds his own comments to his reports of Ammonius' discussions.³⁸ The commentary on *GC* II 11 is an example of such a 'layered' discussion: we have the main interpretation which must have been stated by Ammonius, and a number of brief interjections which could be by Philoponus himself. The main interpretation is given twice, with minor differences: in the *theôria* which forms a preface to the

³⁷ One could draw a parallel with a modern semantic definition of necessity in modal logic as truth in all possible worlds; of course, Aristotle's 'possible worlds' have rather unusual constraints, but the basic type of justification seems to be similar: in a modern case, truth in all possible worlds; for Aristotle, the infinite set of convertible instances.

³⁸ For a more detailed survey of the composition of this commentary see Kupreeva (2005), 1–16.

whole chapter and in the discussion of the text of Aristotle's argument. The author argues that neither simple nor conditional necessity is possible in the infinite linear regress:

(T15) For if (a) necessity *simpliciter* is this: when upon that which is first, when it [already] exists, what is posterior of necessity follows, having necessity due to its own nature, and [if] (b) it is not possible to assume the first and the posterior in the infinite, it is manifest that (c) in this case there will be no necessity *simpliciter*. (d) But nor [will there be necessity] *ex hypothesi*, as he says,³⁹ which was: 'if what is posterior, then of necessity also what is prior'. If, therefore, there is no prior and posterior in an infinite straight line, then not just necessity *simpliciter* is not there in it, but nor is there necessity *ex hypothesi*, for the same reason.⁴⁰ (309.10–19)

The argument is that because there is no first and last member in an infinite series as a whole, it is impossible to speak of a relation of prior and posterior in a proper sense, and therefore the definitions of conditional and simple necessity (understood here as necessity operating between the earlier and the later) do not apply. It is not clear to what extent this argument depends exclusively on the crucial reading of line 337b26 in Aristotle's text that was accessible to the source of this argument in Philoponus' commentary (perhaps Ammonius). The *theôria* version of the argument contains an additional reason in support of the impossibility of conditional necessity:

(T16) For it is generally impossible that anything could have come to be in the infinity. For each of the things assumed as having [so] come to be has an infinite distance from the beginning, such that it would have been impossible for this thing to traverse it and end up at the point at which it would have come to be. (304.25–28 = (ad)–(ae) in Appendix 1 below)

This reasoning shows a number of parallels with the discussion of Aristotle's proof of the cyclical pattern of elemental transformations in the commentary on GC II 5 (see Appendix 2, 3). The point of drawing this parallel would be to deny the linear, non-cyclical pattern in the natural processes. This point seems to be picked up in the objection to the described interpretation of Aristotle's argument against infinite series stated by Philoponus:

³⁹ This shows that the text of 337b26 that the author has is ἀλλ' οὐδ', cf. p. 222n33 above.

⁴⁰ This is the version in the comment ad loc. The version in the preface to chapter contains separate arguments for the 'ascending' and 'descending' regress, showing, respectively, that there can be no first member among the antecedents and no last one among later outcomes, with the same conclusions about the impossibility of both simple and conditional necessity in an infinite straight line (see Appendix 1).

(T17) [309, 20] But we should realise that the argument like this apparently is not well formed to reach its goal.⁴¹ For if (i) someone wanted to eliminate an infinite straight line and said that nothing can come to be in an infinite straight line, since everything that comes to be comes to be for the sake of some end, but every infinite thing is⁴² without an end, he would say something that is both true and irrefutable (for there can be no infinite straight line at all). But if (ii) he assumes an infinite straight line, and since the infinite is without a beginning and without a limit, he says that on it, it is impossible for the second to follow upon the first of necessity, his argument will not be plausible. (iii) For although there is no beginning and no end, there still is succession and the coming to be of this after this. In this way, at any rate, Aristotle while saying that time has neither beginning nor end still says that succession and the first and the second are observed in it.⁴³ So, as far as Aristotle's claims are concerned, necessity will not be eliminated. (309.20–31)

The authorship of this objection is not entirely clear; but Philoponus himself is a very likely candidate. This objection is a one-off criticism of the weak points of the twice-repeated main argument, and does not seem to start a new line of argument.⁴⁴ Philoponus endorses the view that no process in the world can have an infinite regress as its model because of the teleological causality by virtue of which there must be an end to each process. But he points out that once the infinite straight line is assumed (perhaps for the purposes of analysis), we can speak of things being prior and posterior in a linear order, and earlier and later in time (the time represented in its totality by an infinite straight line). He shows no awareness at all of the analysis of the kind given by Alexander, nor of a different reading of Aristotle's text.⁴⁵ It is possible that he took

⁴¹ 309.20: μή κατορθωμένον: i.e. there is an ambiguity in the statement of the argument leaving open the possibility of a reading on which the argument is either not valid or not sound. Cf. Philop. In GC 98.20 where κατορθοῦν is opposed to ἀμυβιάλλεσθαι (cf. Vitelli's *Index verborum* s.vv.).

⁴² 309.23, reading ἔστιν instead of εἶναι as Vit. suggests in apparatus.

⁴³ 309.28, 30: *Ph.* IV 11 (on definition of time); *Ph.* VIII 1, VIII 8 (on time being infinitely divisible).

⁴⁴ This is characteristic of several departures from the main line of the argument in the commentary; in Kupreeva (2005) 161n473, I suggest that these might be Philoponus' ἰδία ἐπιστάσεις, against Sharples (1994), 121n120 who treats the whole passage as a part of the 'mainstream' argument which he attributes to Philoponus. I believe that tracking the difference between this objection (T17) and the preceding argument (T16), apart from its being in order for mere pedantic reasons, can allow us to trace a common position behind some of these objections.

⁴⁵ There is a tantalising question of the role of Alexander's commentary in Philoponus' commentary on this chapter. From reference at 314.10 it is clear that it has been consulted in some way, either by Ammonius or by Philoponus, but it is unclear what different

the concept of conditional necessity used by Aristotle in the sense of hypothetical necessity imparted to the process by its final cause. In the commentary on 337b22–23, after the explanation of Aristotle's thesis that direct necessity between the earlier event and its later outcome obtains only if the outcome is necessary simpliciter, we find a long objection based on the examples of natural processes whose outcomes, the author says, are necessary, even though they are not necessary simpliciter:

(T18) But it will seem that many facts are in conflict with Aristotle's arguments. For we see that many among natural things, generable and perishable, of those that necessarily follow upon certain things that have preceded them, have the necessity of coming to be not because of themselves but because of the things that have preceded them, e.g. upon starvation, emaciation follows of necessity, not because it by itself has necessary coming to be, but because of the starvation that has preceded [it]. For emaciation does not come to be out of necessity by itself, but when starvation has preceded. In the same way, too, when much has been eaten, beyond the capacity to digest, slow digestion will follow, not because of itself, and after a blow [inflicted] upon a fleshy part a weal will follow, not because of itself, but because of the blow, and after water has been poured over the earth mud will follow out of necessity, not because of itself. And there are many other [cases] where the second follows upon the first of necessity, not because of itself, but because of the first.

And neither is this always convertible: for it is not the case that if [there is] slow digestion, then always too much has been eaten, but this happens to come about also because of worries, insomnia and other causes; and upon killing death follows of necessity, however, it is not the case that if there is death, killing has also preceded. (308.13–28)

These objections have been considered in the first part of the paper (see p. 213n21 above). Underlying is the view of simple necessity as operating independently from any teleological factors in a narrow sense, not the simple necessity in a logically precise sense required by the analysis of causal nexus in *APo.* II 12 and *GC* II 12. There is no reply to these objections in the commentary. Moreover, as we have seen, the objections seem to persist in modern scholarship. And even though they can be partly answered by this clarification of Aristotle's project in these two texts, there still remains a question about the relation between the modal simple necessity in logic and the necessary patterns in natural processes.

interpretation of Aristotle's argument it offered (cf. p. 223n34 above) and whether it influenced the 'main' argument of Ammonius/Philoponus.

3.3. *Necessity in Natural Cycles?*

As we have seen, in *APo.* II 12 Aristotle uses the example of elemental transformations as a tentative illustration of the type of counter-predication among the terms that is required to validate the deduction of the later outcome from the earlier cause. In *GC*, we find a discussion of all the three main types of cycle found in Aristotle's physical corpus: elemental transformations, biological reproduction, and heavenly rotation. Only one type (heavenly rotation) is shown to be an adequate model for the deduction of the later outcome from the earlier state of affairs.

The cyclical pattern is essential for elemental transformations. Earlier in *GC* II, Aristotle provides a detailed argument which involves a refutation of a 'linear infinite' model for these transformations. In *GC* II 2, Aristotle constructs the notion of an element ('simple body') that is constituted by a pair of elemental qualities, so as to arrange for mutual transformations between the elements based on the exchange of elemental qualities (which are two pairs of contraries).⁴⁶ In *GC* II 5, he describes three different paths of transformation, all based on the same principle of prevalence: two opposite qualities, hot and cold, constituent of two different elements, exercise their action upon each other: the greater intensity of action (which depends on the mass of respective elements) determines the direction of transformation.⁴⁷ So, in the case of elemental transformations, the role of cyclical pattern is not to establish a definitive path matching the logical concept of necessity. On the contrary, contingency of the outcome of each elemental 'reaction' seems to be an important result of this proof. Nonetheless, in *GC* II 11, a particular type of elemental transformation is considered as a candidate for some sort of sublunary necessity:

⁴⁶ This arrangement is not equivalent to a *demonstration* of each element from every other one: the commentators understand this correctly when they emphasise that the elements are not the elements of each other, but of all other things, cf. Philop. *In GC* II 5, 243.18.

⁴⁷ (1) The fastest one follows the order of subsequent transmission of the active σύμβολον; when less fire is overridden by more air, and the resulting air is overcome by more water, and the resulting water is overcome by more earth: (hot+dry) + (hot+moist) + (cold+moist) + (cold+dry)— (cold+dry). (2) The second way consists in the simultaneous transformation of the two qualities into their opposites: hot+dry \Leftrightarrow cold+moist; hot+moist \Leftrightarrow cold+dry. (3) The third way consists in the transformation of the two non-neighbouring elements into the third one by removing one quality in each of the initial agents: (hot+dry) + (cold+moist) \Leftrightarrow (dry+cold) + hot + moist.

(T19) (1) If that which is moved in a circle moves something continually, the movement of these things must also be in a circle. For example, the locomotion above it being in a circle, the sun moves in this way, and since it moves in that way, the seasons because of it come to be in a circle and return upon themselves, and since these come to be in this way, the things affected by them do so in their turn.

(2) Some things, then, are obviously like this; water and air, for instance, come to be in a circle, and if there is a cloud it is bound to rain and if it rains there is bound also to be a cloud. Men and animals, on the other hand, do not return on themselves in such a way that the same one comes to be again (since there was no necessity, given that your father came to be, that you should have come to be, only that he should have, given that you did), and it seems that this coming to be is in a straight line.

(3) Why is there this difference? This again is where the investigation begins: do all things return on themselves in the same way, or not, but rather some in number and some only in form? It is obvious that those whose substance, i.e. what is moved, is imperishable will be the same in number, since movement follows the thing moved, but those whose substance is, on the contrary, perishable, must necessarily return on themselves in form, not in number. That is why water from air and air from water is the same in form not in number; but if these too are the same in number, still they are not things whose substance comes to be, the sort, namely, that is capable of not being.

(GC II 11, 338b1–20 transl. Williams)

Having drawn a distinction between the things that move in a circle and the ones whose coming to be is in a straight line (1) Aristotle cites the elements as an example of the former class versus biological species whose reproduction, it is suggested, follows a linear, non-recurrent pattern (2). In (3), he introduces a further distinction, between the individual recurrence and the recurrence of species. In the light of this distinction, it seems, both elemental and biological cycles can be considered in two ways, namely, at the level of species and at the level of individuals. However, Aristotle does not say here that the recurrence of species in biological reproduction has necessity. This generalisation is proposed by Alexander of Aphrodisias in *Quaest.* III 5.

(T20) (a) Someone might raise the difficulty whether the consequence 'if what is first, [then] also what is later' is true of the things that come to be in a cycle and return again. Well, this consequence is true of the things that are brought about in a determinate fashion by the bodies that move in a circle. If the winter solstice, [then] also the [spring] equinox, and if the [spring] equinox, [then] also the summer solstice, and if the summer solstice, [then] also the [autumn] equinox, and if this, the winter solstice; and (also), if winter, [then] also spring, and if spring, summer, and if sum-

mer, autumn, and if autumn, winter again. And in the case of the things mentioned first [i.e. the solstices and equinoxes] the ordered sequence is determinate and permanent and is never retarded or advanced, because the sole cause of the being and ordered sequence of these things is the movement of the primary [i.e. heavenly] bodies, nothing else contributing towards it; and for this reason it is possible in the case of these things to determine the time, too, and say [not only that they will be of necessity, but] when they will be of necessity.

(b) But summers and autumns and winters no longer possess determinacy in a similar way, although they come to be in a cycle and they too themselves follow on the motion of the eternal [bodies], because matter too contributes to their coming to be, being affected by the movements of [the eternal bodies]; and since [matter] does not in every respect, in the way in which it is affected, follow the movements and revolutions of [the eternal bodies] in a similar way, [for this reason the seasons] are not determined in the individual details of the way in which and time at which they come to be] in the same way [as are the solstices and equinoxes].

(c) And indeterminacy is still more [present] in those things that need more things to contribute to their being; and among these is the coming to be of living creatures. And for this reason it is true of them, [speaking] generally, that each of them is everlasting as regards the species (and the cause of this [eternity] is the revolution of the divine [bodies]), but [as for] the coming to be of individuals, in the case of which the cause from the proximate efficient [causes] has the greatest influence, of these 'if what is first, [then] of necessity what is later' is not true, but 'if what is later, [then] of necessity what precedes it' is true. (89.2–24, trans. Sharples)

Several points made by Alexander are important for understanding the force of Aristotle's analysis of necessity. Alexander combines in one picture the causal role played in the generation and corruption by heavenly bodies and proximate sublunary causes. The somewhat paradoxical result of this combination is that in the grand scheme of things, on the ladder of being (from the sublunary to heavenly processes) the increasing role of necessitation *a tergo* is accompanied by the diminishing causal, explanatory link between the successive processes in question. The only pure case of such necessity properly speaking is that of heavenly rotations. But different stations of heavenly bodies do not cause each other *qua* individual events, they are only co-ordinated with each other, and that coordination possesses necessity. As Alexander says, solstices and equinoxes do not cause each other, but have one, to a certain extent common, cause.⁴⁸ The greater the causal import of proximate causes, the less the 'necessitation'

⁴⁸ Notably, Averroes makes this remark in his commentary on *APo.* II 12 in his discussion of the last part of the chapter, to do with universal coming to be.

between the elements of a series. Necessity and causation seem to get an epistemological reconciliation at the expense of the ontological split. The recurrence at lower levels (seasons corresponding to the level of elements (b), and biological reproduction (c)) is less determinate, although the role of causal nexus between the processes in one series is much more tangible. We may recall at this point Aristotle's claim in *APo.* II 12 that in some cases the middle term holds 'for the most part'.

Further, according to Alexander, matter is the factor of indeterminacy in the sublunary realm, i.e. matter is responsible for the fact that the regular pattern of recurrence can be violated. So, the necessity induced by material causation is shown to have a source distinct from that of logical necessity. The regularity 'for the most part' is thus a result of a combined action of two kinds of necessity, and this result by itself does not possess necessity strictly speaking in either the first or the second sense. One can see the metaphysical significance of this result, both in Alexander's own discussion of the problems of determinism and in the later Neoplatonic discussions of the hierarchy of principles. It is important to note once again that the starting point and the outcome of Alexander's discussion are closely related to the problem Aristotle discussed by Aristotle in *APo.* II 12 and the method of that discussion.

APPENDIX

1. Philoponus *In GC* II 11, 304.16–32 (second version of reconstruction of Aristotle's argument)

(i) To [things] that move in an infinite straight line necessity *simpliciter* will not belong because we say that necessity *simpliciter* is where the second follows upon the first of necessity,⁴⁹ but in the case of infinity, there is no prior and posterior,⁵⁰ for it is without a beginning and without a limit.⁵¹ For (a) it is not possible to assume necessity *simpliciter* in the case of

⁴⁹ 304.18–19: $p \rightarrow \Box q$, but from the argument (ia) below it is clear that the intended logical form of this is $\Box(p \rightarrow q)$, because the necessity *simpliciter* is supposed to be imparted by p to q . Aristotle's idea of simple necessity does not necessarily include the condition of its being imparted. But in minimal modal logic, the claim $\Box(p \rightarrow q) \rightarrow (p \rightarrow \Box q)$ is not valid, and in order to get $\Box q$ from valid $\Box(p \rightarrow q) \rightarrow (\Box p \rightarrow \Box q)$ we need to assume $\Box p$.

⁵⁰ 304.19: τὸ πρῶτον καὶ τὸ ὕστερον, can be taken in either temporal or causal sense.

⁵¹ 304.20: ἀναρχον γὰρ καὶ ἀπεράτωτον: καὶ is treated by our commentator here not as epexegetic, so that ἀρχή is understood as πέρας (as it is correctly explained by Alexander in his exegesis of 337b27–29, Alexander, *Quaest.* II 22, 71.23 Br., cf. Joachim ad loc., Sharples (1979), 37), but as a real conjunction.

past events, so as to say that *because* of the first that which came to be second followed: (aa) for it is totally impossible to assume the beginning and the first of infinity.⁵² (ab) But if it is not possible to assume the first, the second will not be there either. (ac) Hence, nor will there be necessity *ex hypothesi*.⁵³ (ad) For it is generally impossible that anything could have come to be in the infinity. (ae) For each of the things assumed as having [so] come to be has an infinite distance from the beginning, such that it would have been impossible for this thing to traverse it and end up at the point at which it would have come to be.⁵⁴ This, then, is the case with past events. In a similar way, (b) in the case of future [events] necessity *simpliciter* is impossible in infinity: for there is no 'posterior' in infinity.⁵⁵ Hence it will not be possible to say that if this came to be, that which is posterior will follow. Thus, it is clear from this that necessity *simpliciter* does not belong to things that move along a straight line in infinity.

2. Aristotle, GC II 5, 332b30–333a13

That it is not possible to proceed to infinity ... can be shown from the following. If the next move of F, i.e. fire, is to change into something else (and not turn back), e.g. into X, there will be a contrariety between fire and X other than those mentioned, because by assumption X is identical with none of the group EWA_F. Let G belong to F, B to X. G will belong to all the group EWA_F, since they all change into one another (this, however, ought not at this stage to be taken as proved). But so much, at least, is clear: if X in its turn is to change into something else, another contrariety will belong to both X and F, i.e. fire. Equally, it will always be the case that as a new member is added to the series a contrariety attaches to the previous members, so that if the series goes on to infinity the number of contraries which attach to a single member will also be infinite.

In this case it will not be possible for anything either to be defined or to come to be; (i) for, if it is to be one from another, it will be necessary for that many contraries to be gone through, and still more. So there will be some things into which there will never be change. (ii) This will happen if the number of intermediate stages is infinite, and this will necessarily be the case if the elements are infinite in number. (iii) Again, there will be no change from air into fire if there are infinitely many contraries. (iv) Furthermore, everything will come to be one.

⁵² 304.22–23.

⁵³ 304.23–24: this possibly reflects Aristotle text at 337b26–27; Bruns, followed by Sharples, takes this to be an evidence that Philoponus is committed to the view that there can be no hypothetical necessity on an infinite line, but this may in fact be a view of his source (see p. 222n33, p. 225n39 above).

⁵⁴ The argument (ae) differs from the preceding one in understanding infinity as infinite divisibility. Cf. the argument in GC II 5 against the view that elements could be infinite in number in the following text (Appendix 2).

⁵⁵ 304.29.

(This proof presupposes that by 'change' we understand the change of any arbitrary element into any arbitrary one. The methodological role of these proofs is to back up the selection procedure by which the four elements were established in GC II 3, showing the advantages of this system and the disadvantages of the alternative systems. This point is underscored by Philoponus who argues that any change among the elements will be impossible if change is taken to be an asymmetric relation.)

3. Philoponus *In GC* 257.7-13

But it is best to understand this argument in this way, as elaborating the theorem *per se*, in its own nature, rather than as continuous with the preceding argument. (a) For if you say that (i) F changes into X and (ii) X neither turns back to F, nor changes [into it] then (iii) X has no contrariety in relation to F. (iv) For had it had one, X would have been liable to change into F; (v) it follows that it will be the same [as F]. In this way going through the sequence [of elements], you will prove that all [the elements] are the same with one another. (b) But if someone says, 'I have assumed this very thing in the beginning, that these, F and X, have contrariety in relation to one another, just as I assumed that F changes into X', I will say to him: 'This very contrariety that you assumed you yourself are destroying when you say that X no longer changes into F. And in this way, in general, having assumed that the [elements] above do not change into the ones below you destroy their contrariety which you assumed in the change of every one in relation to the following one. And the contrariety having been destroyed, all will be the same with each other, as he has reasonably concluded.'

(The two assumptions attributed to the proponents of linear change are: (i) F changes into X; (ii) X does not change into F. From this, our author concludes (iii) X does not have a contrariety with F (conclusion explicated in (iv)). (v) follows from the fact that X has no contrariety with F. The author seems to assume that relation 'has contrariety with' is asymmetric either, so that while F may have contrariety with X, X does not have contrariety with F, and therefore may be considered as 'the same as' F. 'Is the same as' thus also may lose its symmetry in this interpretation (although this is never explicitly stated).)

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